

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

Volume I. AGRO-ECOLOGICAL ZONATION

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1. INTRODUCTION

This volume is the first volume in a series of studies directed towards agro-ecological zonation of Tanzania. This zonation is the result of the other studies (volume II on soils, volume III on farming systems, volume IV on mapping units and Volume V, annexes). The intention of the zonation is to have a geographical database to be used for further interpretation. This interpretation within the IPNM-subprogramme is meant to indicate technical options for soil fertility management. Both agro-ecological and farming systems zonation maps have been produced at ARI Mlingano.

The work started by using the agro-ecological zonation and the 1:2.000.000 physiographic unit map of de Pauw (1984). Other sources of information¹ used are the coffee suitability map (CMU, 1998) with suitable information about geology. NCU produced a useful database and a map on agro-ecological zones and this information was incorporated as much as possible. Several publications on farming systems zonation have been used wherever possible (NZ, LZ, SH). Climatic data, especially on drought stress were included in the characterization of the climatic conditions. The workshop on farming system zonation (Mlingano, 2000) was useful in designating land use types in the various areas of Tanzania.

¹ References:

- Coffee Management Unit (CMU), 1998. Coffee suitability map (P. Oosterom, E.G. Kaitaba), CMU, Dar es Salaam
- Enserink, H.J., E.G. Kaitaba, 1996. Farming systems zonation, Lake zone, Tanzania. ARI Ukiriguru, Mwanza, Tanzania
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- National Coordination Unit (NCU), 1996, database and farming system and agro-ecological map
- National Coordination Unit (NCU), 1996. Variety preference survey report and analysis of the variety development research programmes (A. Stroud), NCU/FSR, DRT/MoAC, Dar es Salaam
- National Soil Service (NSS), 2000. Proceedings of the farming system zonation workshop (J.L. Meliyo), ARI. Mlingano
- Nyenzi, B.S. et al., 1997. A study on long range weather forecasting in Tanzania, Research Rep. No. I/97, Directorate of Meteorology, Dar es Salaam
- Pauw, E. de. 1984. Soils, physiography and agro-ecological zones of Tanzania. Crop monitoring and early warning systems project GCPS/URT/047/NET, Min. Agric., FAO, Dar es Salaam.

2. METHODOLOGY

In 1984 the FAO publication by de Pauw showed the agro-ecological zones of Tanzania and gave a lot of information about physiography, climate and indications about soil types. Special attention was given to moisture stress. In 1998 the CMU coffee suitability map elaborated on the study by de Pauw, giving more information about the geological base. Both sources have been used in this study.

A total of 208 mapping units have been distinguished and these were mapped at 1:2.000.000 national scale. Information relevant to any new agro-ecological base has been used wherever mapping units seemed worth to be distinguished at that scale.

The relevant information for each mapping unit was assembled. Sorting of de Pauw's soil units was elaborated by making many more soil/geology units, using information by de Pauw and CMU.

Information about farming systems was started during a workshop at Mlingano in April 2000. A number of broad farming systems has been distinguished and its relation to the mapping units was tentatively established.

By combining and cross-referencing a total of 42 farming system groups were made, establishing a set of topo- and climosequences with each its specific land use. Each of these sequences is related to one or more soil groups. Each soil group has a special set of soil types related to the geology and probably topography.

By combining the topo-sequences and climo-sequences with the climatic and temperature data of the mapping units, the final set of 74 agro-ecological zones were identified. Each of such a zone has a more or less specific set of conditions in terms of climate, geology, soil types and farming characteristics.

In volume IV existing information for each agro-ecological zone about constraints and added information on possible constraints by applying a suitability classification for maize has been compiled. This forms the basis to apply IPNM strategies and from there onwards towards extrapolation of IPNM technical options for three categories of farmers. The information available from the farming system zonation maps by zone give additional information about bio-physical, socio-economic and institutional data.

Most of the data need verifications during the coming period. An extended database on soil profile descriptions with their exact geographic locations has to be build up. Crop response data have to be worked out for various zones. Mapping can be improved by using existing survey and land cover data

3. LEGEND OF THE AGRO-ECOLOGICAL ZONES MAP

The legend of the agro-ecological map is composed of various components:

- Rainfall and drought as well as temperature conditions (eight categories)
- Geological conditions (nine categories)

The rainfall, drought and temperature division is given in Table 3-1.

Table 3-1. Rainfall, drought and temperature conditions

Category	Average annual rainfall (mm)	Rainfall pattern	Drought risk	Temperature
a	More than 1000 and up to 1300-2000 or more	Monomodal	Low	Cool-very cool
b	More than 1000 and up to 1000-2600	Mono- to bimodal	Low to moderate	Intermediate to warm
c	More than 800 and up to 1200-1400	Monomodal	Low	Intermediate to cool
d	More than 700 and up to 900-1300	Transitional or intergrade to mono- or bimodal	Variable	Cool to warm
e	More than 600	Mono- or bimodal or transitional	Variable	Cool to warm
f	More than 500, variable	Mono- or bimodal or transitional	Relatively low	Intermediate or intergrade to cool or warm
g	More than 500	Intergrade monomodal-transitional or bimodal-transitional	Higher than f.	Cool to warm
h	More than 400 and up to 600-800	Mono- or bimodal or transitional	Low to very high	Intermediate

The geological division, including some climatic data is given in table 3-2.

Table 3-2. Geological division of the agro-ecological zones

Category	Geology	Climatic data
Vo	Volcanic ash	Cool, higher altitudes
Gn	Gneiss	Cool to intermediate
Ka	Metamorphic and sedimentary rocks (Kagera-Kigoma)	Cool to intermediate
La	Lacustrine sediments	Intermediate altitudes
Sa	Sandstone	Intermediate to warm
Lw	Various rocks and sediments (Lake and Western zone)	(Cool to) intermediate
Se	Various sediments	Intermediate altitudes
Me	Gneiss, schist, granite	Variable
Co	Coastal sediments	Warm, low altitudes

The geological conditions have been sub-divided into a total of 17 units with different soil types, which are called broad agro-ecological zones:

- Vo-I, volcanic ash areas, Southern highlands ((Andosols, Nitisols, Ferralsols, Acrisols)
- Vo-II, volcanic ash areas, Northern zone (Pheozems, Andosols, Solonetz, Nitisols, Vertisols, Histosols)
- Gn, gneiss areas, Southern Highlands (Mbeya, Iringa, Rukwa, Ruvuma), Eastern, Northern, Central zone, including Tarime highland and Pangani river valley (Lithosols, Phaeozem/Calcisols, Nitisols, Luvi/Acrisols, Ferralsols, Vertisols, Solonetz, Solonchaks)
- Ka-I, Western Kagera, Kigoma (Lithosols, Nitosols, Ferralsols, Acrisols, Gleysols, Histosols, Fluvisols)
- Ka-II, Eastern Kagera, Southern Highlands (Rukwa), including Kigoma lakeshore (Luvi/Acrisols, Ferralsols, Acrisols, Gleysols, Histosols)
- La-I, Lake zone, Igunga area, Lake Manjaro eastern shore and lake Natron shore Phaeozems, Paleosols, Hardpan soils, Vertisols, Solonetz, Solonchaks)
- La-II, Southern Highlands (Rukwa, Iringa)(Litho/regosols, Luvi/Acrisols, Arenosols, Hardpan soils, Fluvisols, Vertisols, Solonetz, Solonchaks)
- Sa-I, Southern, Eastern zones and Southern highlands (Ruvuma) (Lithosols, Cambisols, Arenosols, Vertisols)
- Sa-II, coastal hinterlands (Lithosols, Phaeozems/Cambisols, Gleysols, Vertisols)
- Lw-I, Kagera (Lithosols, Ferralsols)
- Lw-II, Sukumaland (Lake zone), Western, Central zones (Luvi/Acrisols, ferralsols, Paleosols, Arenosols, Hardpan soils, Gleysols, Vertisols, Histosols, Fluvisols)
- Se, Sukumaland (Mbuga areas), Ibushi-Lake Eyasi plains and Central flooded/irrigated area (Phaeozems/Cambisols, Hardpan soils, Vertisols, Solonetz, Solonchaks)
- Me-I, Lake, Central, Western zones and Southern Highlands (Rukwa, Kyela, Nyasa) (Lithosols, Phaeozems, Fluvisols, Cambisols, Ferralsols, Paleosols, Acrisols, Arenosols, Gleysols, Vertisols, Solonetz, Solonchaks)
- Me-II, Eastern and Southern Highlands (Luvi/Acrisols, Ferralsols, Paleosols, Acrisols, Arenosols, Hardpan soils, Fluvisols)
- Me-III, Eastern and Southern alluvial plains (Fluvisols, Luvi/Acrisols, Arenosols, Hardpan soils, Acid sulphate soils, Vertisols, Solonetz, Solonchaks, Histosols)
- Co-I, coastal plains and eastside of islands (Luvisols, Arenosols, Gleysols, Vertisols)
- Co-II, coastal hinterland plains and westside of islands (Cambi/Luvisols, Paleosols, Acrisols)

The legend units of the broad agro-ecological zone map are given in Table 3-3.

Table 3-3. Legend units of the broad agro-ecological zones map

AEZ	Clim. cat.	Rain pattern	Drought risk	Temp	Grow. season	Land use dens.	Carr cap.	Farming system group	Soil group
Vo-I, Southern highlands									
Vo-1a/1b	a	mono	low	1	>6-8+	vh	h	1a1,2a2	1a,1b
Vo-2	c	mono	low	1	6-9	vh	h	1d2	2
Vo-4a	e	mono	low	1	6-9	vh	h	2a2	1b
Vo-II, Northern zone									
Vo-1c	a	mono	low	1(-2)	>5-7+	vh	vh	2c1	4a
Vo-3	d	trans-bi	mod.	1-2	3-5/6	mod-vh	l-h	2c1	4a
Vo-4c	e	bi	mod.	2	past.	vl	var	2k1	4b
Vo-5a/5b	g	bi-trans	mod-vh	1-2	nd	var.	var.	2c1,2k1	4a,4b
Vo-6	h	bi-mono	h-vh	2	nd	vl	l	2k1	4b
Gn, Southern Highlands (Mbeya, Iringa, Ruvuma, Rukwa), Eastern, Northern, Central zones									
Gn-1a/1b	a	mono	low	1(-2)	>5-8+	mod-vh	mod-h	2a1,2c2	3,5a
Gn-2	b	mono	low	2(-3)	>4-5/9	mod-vh	h	2c2	5a
Gn-3	c	mono	low	1-2	>5-9+	mod-vh	l-mod	2c2	5a
Gn-4	d	trans	mod	(1-)2	3-4.5/6	mod	mod	2f1	5b
Gn-5a/5b/5c Vo-4b	e	var.	l-mod	1-2	5-10	mod-vh	var.	2a1,2c2 2f1	3,5a, 5b,6
Me-6b*	f	trans	low?	2	2-3.5	l	l	2g1	25e, 5b
Gn-6a/6b Vo-5c	g	var.	mod-h	1-2	2/3-4.5/6	var.	l	1j1,2c2 2f1	5a,5b 16
Gn-7	h	bi-mono	h-vh	2	nd	l-vl	vl	2f1	5b
Ka-I, Western Kagera, Kigoma									
Ka-1	a	mono	low	1	6-8	h	mod	1a2,2b2	7a,7c
Ka-3a	c	mono	low	1	6.5-8	h	mod	1d1	7b
Ka-4a/4b	d	bi (-trans)	low	(1-)2	>4-9	h	mod	2b2,2h1	7c,10
Ka-4b	f	bi	low	(1-)2	>4	h-vh	mod	2h1	10
Ka-II, Eastern Kagera, Southern Highlands (Rukwa)									
Ka-2	b	bi	low	2	>7	h-vh	mod	2b1	29a
Ka-3b Lw-1a	c	mono	low	1-2	>5-8/9?	vl	l	1f2,2b1	20, 29a
Ka-4c	d	trans-mono	low	2	4-5/7.5	l-vh	l-mod	1f3,2b1	29a, 29b
La-I, Lake zone, Igunga area (WZ), lake Manjara eastern shore, lake Natron shore									
La-1	d	trans	mod	2	3-4.5-6?	vh?	l?	2l2	8
La-3	g	mono-trans	l-mod	2	3-3.5	vh?	vl?	2l2	8
La-4b	h	bi	h-vh	2	nd	vl	nd	2l2	8
La-II, Southern Highlands (Rukwa, Iringa)									
La-2	e	mono	low	2	5-9	l (mod?)	mod	2o1	11
La-4a	h	mono	low	2	3-5	l	vl-mod	2o1	11
Sa-I, Southern, Eastern zones, Southern highlands (Ruvuma)									
Sa-1	b	mono	low	2(-3)	5-7	mod	h	2i1	14
Sa-2a	d	trans	mod	(2-)3	4-7	l	l	2l1	14
Sa-3a	e	mono(-trans)	low	2-3	<5-7/9	l-mod	l	2i1	14
Sa-II, Coastal hinterland									
Sa-2b	d	trans	mod	3	3-4.5+1-2	mod-vh	l	1g1,2n1	15a, 15b

Sa-3b	e	bi	h-vh	3	<3-4.5 + 1-2	mod	l	2n1	15b
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Lw-I, Kagera, Ngara

Lw-2a	d	trans	low	(1-)2	4- 7/10?	nd (h?)	nd (mod?)	2d1	17
Lw-3a	f	bi	low	1-2	nd	h?	mod?	2d1	17

Lw-II, Sukumaland (Lake zone), Western and central zone

Lw-1b	c	mono	low	2	5-6	vl	mod	1f1	13
Lw-2b/2c	d	var.	l-mod	2	3-6	var.	l-mod	2h1, 2h1	10, 18
Lw-3b	f	mono(- trans)	low	2	3-5	vl-mod	l-vl	2h2	18

Se, Sukumaland (Mbuga), Ibushi-Lake Eyasi, Central flooded/irrigated area

Se-1	d	trans	low	2	3-3.5	h?	vl?	2l1	22b
Se-2	f	mono(- trans)	low	2	3-3.5	h	vl	1j2, 2l1	22a, 22b
Se-3a	h	trans	low	2	nd (3-5?)	nd	nd	2l1	22b

Me-I, Lake, Central, Western zones, Southern Highlands (Rukwa, Kyela, Nyasa)

Me-1	a	mono	low	1	6-8.5	vl?	l	2b3	25c
Me- 2a/2b/2c	b	var.	low	2-3	4->8	h-vh	var.	1b1, 1c1 2b3, 2g1	9, 25b 25c, 25e
Me-3	c	mono	low	1	5-9	h	mod	1e1	25a
Me-4a	d	mono(- trans)	low	(1-)2	4-6	l-vh	l	1e1, 2b3 2d2, 2g1	25a, 25c, 25d, 25e
Me-5a	e	mono	low	(1-)2	4-7	l	mod	2d2, 2g1	25d, 25e
Me-6a/6b	f	mono- trans	low	1-2	2-6.5	var.	vl- mod	2d2, 2g1	25d, 25e
Se-3b	h	mono- trans	low-mod	2	3-3.5?	l-mod	l-vl	1k1, 1k2	21a, 21b

Me-II, Eastern zone, Southern Highlands

Me-4b/4c	d	var.	low-mod	2-3	4/6- 6/9	mod- (v)h	l-h	1g2, 2m1	12, 26
Me-5c	e	trans(- bi/mono)	mod	3	3- 5/6.5 or 3-4 + 1-2	mod	l-mod	2m1	26

Me-III, Eastern and Southern zones alluvial plains

Me-5b/5d	e	trans(- mono)	low-mod	3	<3-4.5	var.	l-mod	1h1, 1h3	23, 28
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Co-I, Coastal plains, eastside of islands

Co-1a	b	bi	mod	3	10	vh	h	2e1	19
Co-2a	d	trans-bi	low-mod	3	3-4.5 + 1-2	mod-vh	l	2e1	19

Co-II, Coastal hinterland plains, westside of islands

Co-1b	b	bi	mod	3	4-5 + 1.5- 2.5	vh	h	2j1	27
Co-2b	d	trans-bi	low-mod	3	3-4.5 + 1-2	mod-vh	l	2j1	27
Co-3a/3b	e	trans(- bi)	low-mod	3	<3-4.5	vh	l	1h2, 2j1	24, 27

Descriptions of the broad agro-ecological zones:

- Co-I. Coastal plains and eastside of islands, 700-1200 mm average annual rainfall with bimodal or transitional pattern, warm conditions, low to moderate drought risk, moderately to very highly populated, variable carrying capacity, with major soil

- types like lithosols and arenosols with constraints like soil depth, fertility (N), salinity, workability, low organic matter content with cropping of cassava, trees, maize, sorghum, coconut, sisal.
- Co-II. Coastal hinterland plains and westside of islands, 800-1300 mm average annual rainfall with bimodal or transitional pattern, warm conditions, low to moderate drought risk, moderately to very highly populated, variable carrying capacity, with major soil types like sandy luvi/acrisols, strongly leached paleosols and acrisols with constraints like fertility (N, RP), acidity, workability, low organic matter content, capping/surface sealing with cropping of maize, cassava, trees, sorghum, rice, coconut, cashew, citrus as well as pastoralism.
 - Gn. Areas usually at higher elevation (SH,EZ,NZ,CZ,LZ) underlain by gneiss, wide range of characteristics due to climatic conditions, 400-1600 mm average annual rainfall with bimodal to monomodal pattern, cool to intermediate conditions (with possible radiation and temperature constraints), low to high drought risk, population density and carrying capacity related to rainfall, with major soil types like lithosols, phaeozems/calcisols, nitosols, sandy, loamy and clayey luvi/acrisols, ferralsols, strongly leached paleosols and acrisols with constraints like erosion, fertility (N, RP, P, K, manure), acidity, workability, soil depth, land slides, capping/surface sealing, low organic matter content and in drier parts soil degradation (gully erosion), salinity, sodicity with cropping of coffee, banana, maize, bean, potato, tea, horticulture, sorghum, wheat, pigeon pea, finger millet, sisal as well as pastoralism.
 - Ka-I. Western Kagera and Kigoma highlands, 800-1500 mm average annual rainfall with bimodal to monomodal pattern, intermediate to cool conditions (possible radiation and temperature constraints), low drought risk, highly populated, moderate carrying capacity, with major soil types like nitosols, ferralsols, strongly leached acrisols, fluvisols with constraints like fertility (N, RP, P, K?), acidity, erosion, leaching, soil depth (possibly locally drought stress), capping/surface sealing, flooding with cropping of coffee, maize, bean, banana as well as livestock keeping.
 - Ka-II. Eastern Kagera, Rukwa (Southern highlands), including Kigoma lakeshore, 600-2000 mm average annual rainfall with bimodal to monomodal pattern, intermediate (to cool) conditions (possibly radiation and temperature constraints), low drought risk (drought possible in driest areas), variably populated, low to moderate carrying capacity, with major soil types like sandy acrisols, ferralsols, strongly leached acrisols, arenosols with constraints like fertility (N, RP, P, K, manure, micronutrients), acidity, drainage, leaching, soil depth, erosion, capping/surface sealing, with cropping of coffee, banana, tea, cassava, rice, tobacco, oilpalm as well as pastoralism.
 - La-I. Itogolo areas (Lake zone), Igunga area (Western zone), lake Manjara/Natron, 400-1000 mm average annual rainfall with bimodal to transitional pattern, intermediate temperature conditions, drought risk variable especially according to rainfall pattern (drought is a constraint in all areas), populated according to rainfall, carrying capacity probably relatively low, with major soil types like phaeozems and imperfectly drained hardpan (Itogolo) soils with constraints like drainage, soil degradation (gully erosion), sodicity, capping/surface sealing, fertility (N, P, probably as minor constraint), salinity, workability with cropping of rice, cotton, sorghum as well as livestock keeping and pastoralism.

- La-II. Dry Southern highlands (Rukwa and Iringa), 400-1200 mm average annual rainfall with monomodal pattern, intermediate temperature conditions, low drought risk (however, drought occurs in drier parts, especially in shallow soils), low population density, very low to moderate carrying capacity, with soil types like lithosols, fluvisols, sandy luvisols with constraints like fertility (N, P, probably as minor constraint), flooding, sodicity, salinity, soil depth (drought stress), capping/surface sealing, low organic matter content, soil degradation (gully erosion) with cropping of tobacco, maize, sorghum, rice as well as pastoralism.
- Sa-I. Southern, Eastern and Southern Highlands (Ruvuma) on sandstone, 500-1200 mm average annual rainfall with monomodal to transitional pattern, intermediate to warm conditions (possible with slight radiation constraint at higher altitudes), low to moderate drought risk (drought is a constraint in B-D climatic areas and even in A climatic areas with shallow soil depth), low to moderate population density, low to high carrying capacity related to rainfall, with major soil types like cambisols and vertisols with constraints like fertility (N, P, manure (sandy soils)), soil depth (drought stress), low organic matter, drainage, erosion with cropping of cashew, maize, sesame, bean and including a game park.
- Sa-II. Coastal hinterland, 800-1000 mm average annual rainfall with bimodal to transitional pattern, warm conditions, moderate to very high drought risk (drought constraint in all zones), moderately populated, low carrying capacity, with moderately well drained vertisols as major soil types with constraints like fertility (N, P, manure on sandy soils), salinity, workability, compaction, erosion, low organic matter content, soil depth (drought stress) and cropping of coconut, cassava, cashew, maize, sorghum, sisal.
- Lw-I. Central-Kagera, Ngara, 800-1000 mm average annual rainfall with bimodal to transitional pattern, intermediate to cool temperature conditions, low drought risk (though drought stress possible in drier areas, especially on shallow soils), unclear population density, probably moderate carrying capacity, with ferralsols as major soil types with constraints like fertility (N, RP, P, K, manure), acidity, low organic matter content, flooding, soil depth (drought stress) and cropping of coffee, maize, bean as well as livestock/dairy and ranching.
- Lw-II. Sukumaland (Lake zone) and areas in Western and Central zone, 500-1500 mm average annual rainfall with variable pattern, intermediate temperature conditions, low to moderate drought risk, generally very low to moderately populated, low to moderate carrying capacity, with major soil types like sandy luvi/acrisols, strongly leached paleosols, Itogolo hardpan soils, fluvisols, moderately leached gleysols, vertisols, histosols with constraints like fertility (N, RP, P, K, manure), flooding, drainage, acidity, workability, low organic matter content, capping/surface sealing, soil depth and in the driest areas soil degradation (gully erosion) with cropping of cotton, maize, sorghum, groundnut, rice, sweet potato as well as livestock keeping and pastoralism.
- Se. Mbuga areas (Sukumaland, Lake zone), Ibushi-Lake Eyasi, Central flooded/irrigated areas (Central zone), 400-1000 mm average annual rainfall with usually transitional pattern, intermediate temperature conditions, low drought risk (drought occurs, however, as constraint in all zones), unclear population density, generally low carrying capacity, with major soil types like hardpan soils and vertisols with constraints like

workability, flooding, drainage, fertility (probably only N) and in the driest D-E climatic parts soil degradation (gully erosion), salinity, sodicity and cropping of maize, cassava, cotton, rice, sorghum, millet as well as pastoralism.

- Me-I. Lake, Central, Western zones and Southern highlands (Rukwa, Kyela, Nyasa), with wide range (400-2600 mm) in average annual rainfall with generally transitional to monomodal pattern, usually intermediate to cool, in some lake shore areas warmer conditions, low drought risk (drought occurs as constraint in the drier C-E climatic areas, but also in shallow soils in higher rainfall areas), population density very variable, carrying capacity variable, but generally low to moderate, with major soil types like lithosols, sandy cambisols, moderately leached loamy luvi/acrisols, strongly leached paleosols and acrisols, arenosols, vertisols, solonetz, solonchaks with constraints like fertility (N, RP, manure on sandy soils), acidity, erosion, capping/surface sealing, soil depth (drought stress), workability, low organic matter content, flooding, drainage and in the drier areas salinity, sodicity, soil degradation (gully erosion) and cropping of maize, cassava, cotton, bean, rice, finger millet, groundnut, tobacco, sorghum as well as pastoralism.
- Me-II. Eastern zone and Southern highlands, with 500-1200 mm average annual rainfall with variable pattern, intermediate to warm temperature conditions, low to moderate drought risk (however, drought experienced as constraint in all zones), moderately to highly populated, low to high carrying capacity, with major soil types like sandy and clayey luvi/acrisols, ferralsols, fluvisols (206), strongly leached paleosols and acrisols, sandy hardpan soils with constraints like fertility (N, RP, P, manure on sandy soils), acidity, workability, low organic matter content, capping/surface sealing, soil depth (drought stress), flooding, drainage, soil degradation (gully erosion) and cropping of maize, rice, sorghum, sunflower, groundnut as well as pastoralism.
- Me-III. Eastern and Southern alluvial plains, 800-1200 mm average annual rainfall with transitional pattern, warm conditions, low to moderate drought risk (drought as constraint in all zones), variable population density, low to moderate carrying capacity, with fluvisols as major soil types with constraints like fertility (N, RP, manure on sandy soils), flooding, acidity, low organic matter content (possibly locally salinity in driest areas) and cropping of rice, maize, sweet potato, cassava, sisal.
- Vo-I. Volcanic areas, Southern highlands, wide range 600-2600 mm in average annual rainfall with monomodal pattern, cool temperature conditions (with radiation and temperature constraints at higher altitudes), low drought risk (possible sometimes in case of shallow soils), very highly populated, high carrying capacity, with major soil types like andosols and strongly leached acrisols with constraints like fertility (N, RP, P), erosion (possibly landslides?), soil depth (drought stress), capping/surface sealing and cropping of coffee, maize, bean, banana, potato.
- Vo-II. Volcanic areas, Northern zone, wide range of characteristics due to altitude and wind direction-related rainfall, 400-2000 mm average annual rainfall with bimodal to monomodal pattern, intermediate to cool temperature conditions (radiation and temperature as constraints at higher altitudes), low to very high drought risk (especially high in C-E climatic zones as well as shallow soils in B-E zones), variable population density and carrying capacity related to rainfall and drought risk, with major soil types like phaeozems, andosols, clayey and

sandy nitisols, solonetz with constraints like water erosion, wind erosion, acidity, soil depth, fertility (N, RP, P), and in drier (D-E) areas sodicity, soil degradation (gully erosion) and in the driest areas (E) salinity and cropping of coffee, banana, maize, bean, potato, wheat, pigeon pea, sugarcane, as well as ranching, pastoralism and important parts as game park.

4. AGRO-ECOLOGICAL ZONES IN RELATION TO SOIL GROUPS, FARMING SYSTEM GROUPS, RAINFALL ZONES AND TEMPERATURE ZONES

Table 4-1 shows an overview of the various agro-ecological zones as grouped in broad zones based on the geology, with indications on soil groups, farming system groups, rainfall and temperature zones together with the land use in terms of agriculture (major crops), pastoralism, park. In annex 2 a more detailed list is given. More information on soil groups can be found in volume II and on farming system groups in volume III. The rainfall zones are explained in volume V (annex 5)

Table 4-1. Overview of the agro-ecological zones arranged by geology and their relation with soil groups, farming system groups, rainfall zone, temperature zone and land use

Broad zone	Agro-ecological zones	Soil groups	Farming system groups	Rain-fall zones	Temp zones	Land use
Coast						
Co-I	Co-1a,2a	19	2e1	A-B	3	Cassava, trees, maize, sorghum, rice, coconut, sisal
Co-II	Co-1b,2b,3a,3b	24,27	1h2,2j1	A-C	3	Maize, cassava, trees, sorghum, rice, coconut, cashew, citrus, pastoralism
Gneiss						
Gn	Gn-1a,1b,2,3,4,5a,5b,5c,6a,6b,7	3,5a,5b	2a1,2c2,2f1	A-E	1-2	Coffee, banana, maize, bean, potato, tea, wattle, horticulture, sorghum, wheat, pigeon pea, fingermillet, sisal, pastoralism
	Vo-4b	6	1i1	C	1	Maize, cassava, sorghum, banana, horticulture
	Vo-5c	16	1j1	D	2	Rice, maize, sweet potato
Metamorphic-sedimentary rocks (Kagera-Kigoma)						
Ka-I	Ka-1,3a,4a,4b	7a,7b,7c,10	1a2,1d1,2b2,2h1	A-D	1-2	Coffee, maize, bean, banana, livestock
Ka-II	Ka-2,3b,4c	29a,29b	1f3,2b1	A-B	1-2	Coffee, banana, tea, cassava, rice, tobacco, pastoralism
	Lw-1a	20	1f2	B	2	Cassava, rice, oilpalm
Lacustrine sediments						
La-I	La-1,3,4a	8	2l2	B-E	2	Rice, livestock, cotton, sorghum, pastoralism
La-II	La-2,4b	11	2o1	C-E	2	Tobacco, maize, sorghum, rice, pastoralism
Various rocks and sediments (Lake and Western zones)						
Lw-I	Lw-2a,3a	17	2d1	B-D	1-2	Coffee, maize, bean, livestock/dairy, ranching
Lw-II	Lw-1b,2b,2c,3b	10,13,18	1f1,2h1,2h2	B-D	2	Cotton, maize, livestock, sorghum, groundnut, rice, sweet potato, pastoralism

Gneiss, granite, schist (metamorphic, igneous)

Me-I	Me-1,2a, 2b,2c,3, 4a,5a,6a, 6b	9,25a, 25b, 25c, 25d, 25e	1b1,1c1 1e1,2b3 2d2,2g1	A-D	1-3	Maize, cassava, cotton, cocoa, bean, rice, finger millet, groundnut, tobacco, sorghum, pastoralism
	Se-3b	21a, 21b	1k1, 1k2	E	2	Maize, rice, sorghum, sunflower, groundnut, pastoralism
Me-II	Me-4b,4c, 5c,7	12,26	1g2,2m1	B-D	2-3	Maize, sorghum, millet, rice, cassava, grain legumes, cotton, sesame, sisal, sugarcane, pastoralism, ranching
Me-III	Me-5b,5d	23,28	1h1,1h3	B-C	3	Rice, maize, sweet potato, cassava, sisal

Sandstone

Sa-I	Sa-1,2a, 3a,4,5	14	2i1	A-D	2-3	Cashew, maize, sesame, bean, park
Sa-II	Sa-2b,3b	15a, 15b	1g1,2n1	B-C	3	Coconut, cassava, cashew, maize, sorghum, sisal

Various sediments (lacustrine, alluvial, wash)

Se	Se-1,2,3a	22a, 22b	1j2,2l1	B-E	2	Maize, cassava, cotton, rice, sorghum, millet, pastoralism
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Volcanic ash

Vo-I	Vo-1a,1b, 2,4a	1a,1b, 2	1a1,1d2 2a2	A-C	1	Coffee, maize, bean, banana, potato
Vo-II	Vo-1c,3, 4c,5a,5b,6	4a,4b	2c1,2k1	A-E	1-2	Coffee, banana, maize, bean, potato, wheat, pigeon pea, sugarcane, pastoralism, ranching, park

5. DESCRIPTIONS OF THE AGRO-ECOLOGICAL ZONES

COASTAL SEDIMENTS (Co)

Agro-ecological zones Co-1a, 1b, Co-2a, 2b, Co-3a and 3b.
Areas covered by **coastal sandy and clayey sediments**.

General description:

- Climatic range A-C, transitional (south) to bimodal (north and east)
- Temperature range: 3, warm
- Growing season range: less than 3 to 5 months in long rainy season and 1-2.5 months in short rainy season
- Drought risk: low to moderate, especially with bimodal rainfall pattern
- Soil groups: 19, 24, 27
- Farming system groups: 1h2, 2e1, 2j1
- Land use density: moderate to very high
- Carrying capacity; low to high, depending on annual rainfall and length of rainy season
- Major cash crops: coconut, cashew, sisal
- Major food crops: cassava, maize, sorghum, rice

Sub-division

- Co-I, coastal plains and east-side of islands
- Co-II, coastal hinterland plains and west-side of islands

	E-Zanzibar/ Pemba/Mafia, S+E- coastal plains	S+E hinterland plains with coastal sand cover	W-Zanzibar/ Pemba, E+S coastal and hinterland plains
Physiographic units	CP1-2	CD1-2	CH1,4
CMU	A3	A4d	A4
Farming system group	2e1	1h2	2j1
Soil group	19	24	27
Geology	Limestone, marl, clay	Coastal sand, clay	Coastal sand, clay
	Pleistocene 2	Plio-Pleistocene 2	Plio-Pleistocene 1
Annual rainfall	800-1000	800-1000	800-1300
Altitude (m)	< 200	200	< 200
Climate/temperature regime	A3-B3	B3-C3	A3-B3-C3
Crops	Cass-trees-mai- sorg-rice-c/nut	Mai-sorg-past	Cass-trees-mai- sorg-rice-c/nut- cash

**Average annual rainfall more than 1000 mm and up to 1000/2600 mm,
intermediate to warm conditions**

Agro-ecological zone	Co-1a		Co-1b
Drought risk	Moderate		Moderate
Rainfall pattern	Bimodal		Bimodal
Temperature regime	Warm		Warm
Growing season (months)	10		4-5 + 1.5-2.5
Land use density	Very high		Very high
Carrying capacity	High		High
Major crops	Cass, trees		Cass, trees
Soil moisture	Low to moderate		Moderate

dependency			
Mapping units	A3c		A3b

Average annual rainfall more than 700 mm and up to 900/1300 mm with variable drought risk

Agro-ecological zone	Co-2a		Co-2b
Drought risk	Low to moderate		Low to moderate
Rainfall pattern	Trans-bi		Trans-bi
Temperature regime	Warm		Warm
Growing season (months)	3-4.5 + 1-2		3-4.5 + 1-2
Land use density	Moderate to very high		Moderate to very high
Carrying capacity	Low		Low
Major crops	Mai-sorg-rice-c/nut-cass-sisal		Mai-sorg-cash
Soil moisture dependency	Moderate		Moderate
Mapping units	B3m1-2		B3l1-2

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone		Co-3a	Co-3b
Drought risk		Low to moderate	Low to moderate
Temperature regime		Warm	Warm
Growing season (months)		< 3-4.5	< 3-4.5
Land use density		Very high	Very high
Carrying capacity		Low	Low
Major crops		Mai, sorg, past	Rice, c/nut, cass
Soil moisture dependency		Moderate	Moderate
Mapping units		B3k,C3e	C3f

Soil types specific per farming system group or soil group

Shallow soils	144		
Well dr. sandy Cambi/Luvi/Acrisols	(301,333)		331
Mod. leached, well dr. Luvisols	401		
Str. leached, well dr. Paleosols or Ferralsols/Acrisols		471,472	451
Arenosols	522	(524,525)	(523)
Mod. well dr. Vertisols	(542)		
Poorly dr. Fluvisols		(644,645)	(643)
Mod. leached Gleysols	675		(676)
Poorly dr. Vertisols	721		

Constraints:

- Fertility (some leaching in A-climatic zones, acidity likely, low organic matter content in sandy soils)
- Workability in Vertisols
- Salinity (some salinity problems in B-climatic zones)
- Drought in light textured and shallow soils

Descriptions of the different agro-ecological zones

Co-1a

E-Zanzibar/Pemba, Mafia

- Associated zone: Co-2a
- Mapping unit: A3c
- Geology, parent material: limestone, marl, clay (Pleistocene (2))
- Climatic zones: A, bimodal, 1000-1200 mm annual rainfall; Temperature regime: 3, up to 100 m altitude
- Soil group: 19; Soil types: Shallow soils: 144; Arenosols: 522; Luvisols: 401
- Farming system: Cassava-(spice)trees
- Farming system group: 2e1
- Topography: undulating to rolling
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: low to moderate; Drought risk: moderate; Length of growing season: 10 months
- Constraints:
 - Climatic: drought
 - Soils: soil depth, leaching?, fertility

Co-1b

W-Zanzibar/Pemba

- Associated zones: Co-2b, Co-3b
- Mapping unit: A3b
- Geology, parent material: coastal sand and clay (Plio-Pleistocene (1))
- Climatic zones: A, bimodal, 1000-1300 mm annual rainfall; Temperature regime: 3, < 200 altitude
- Soil group: 27; Soil types: Well drained sandy Cambi/Luvi/Acrisols: 331
- Farming system: Cassava-(spice)trees
- Farming system group: 2j1
- Topography: undulating to rolling
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: moderate; Drought risk: moderate; Length of growing season: 4-5 + 1.5-2.5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, acidity, leaching?

Co-2a

Southern and Eastern coastal plains

- Associated zone: Co-1a
- Mapping units: B3m1, B3m2
- Geology, parent material: limestone, marl, clay (Pleistocene (2))
- Climatic zones: B, bimodal (north) to transitional (south), 800-1000 mm annual rainfall; Temperature regime: 3, < 200 altitude
- Soil group: 19; Soil types: Arenosols: 522; Moderately leached Gleysols: 675; Imperfectly to poorly drained Vertisols: 721
- Farming systems: Maize-Sorghum (2a) and Rice-Coconut-Cassava and sisal estates

- Farming system group: 2e1
- Topography: undulating to rolling
- Proportion of cultivated land: medium to very high; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: low to moderate; Length of growing season: 3-4.5 and 1-2 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, , salinity, workability, low organic matter content

Co-2b

Eastern and Southern coastal sand hinterland plains

- Associated zones: Co-1b, Co-3b
- Mapping units: B311, B312
- Geology, parent material: coastal sand and clay (Plio-Pleistocene (1))
- Climatic zones: B, bimodal to transitional (to monomodal), 800-1000 mm annual rainfall; Temperature regime: 3, < 100-200 m altitude
- Soil group: 27; Soil types: Well drained sandy Cambi/Luvi/Acrisols: 331; Well drained strongly leached Paleosols: 451
- Farming systems: Maize-Sorghum (2a) and Cashew (1)
- Farming system group: 2j1
- Topography: undulating to rolling
- Proportion of cultivated land: medium to very high; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: low to moderate; Length of growing season: 3-4.5+1-2 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, workability, acidity, low organic matter content

Co-3a

Eastern and Southern hinterland plains with coastal sand cover

- Mapping units: B3k, C3e
- Geology, parent material: coastal sand (Plio-Pleistocene (2)) covering limestone, shale and marl
- Climatic zones: B-C, transitional to bimodal, 800-1000 mm annual rainfall; Temperature regime: 3, 200 m altitude
- Soil group: 24; Soil types: Well drained strongly leached Ferralsol/Acrisols: 471+472
- Farming system: Maize-Sorghum-Pastoralism (2) citrus
- Farming system group: 1h2
- Topography: undulating
- Proportion of cultivated land: very high; Carrying capacity: low
- Dependency on soil available moisture; moderate; Drought risk: low to moderate; Length of growing season: <3-4.5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, acidity, capping/surface sealing

Co-3bSemi-arid Eastern and Southern coastal sand hinterland plains

- Associated zones: Co-1b, Co-2b
- Mapping unit: C3f
- Geology, parent material: coastal sand and clay (Plio-Pleistocene (1))
- Climatic zones: C, transitional, 800 mm annual rainfall; Temperature regime: 3, <100-200 m altitude
- Soil group: 27; Soil types: Well drained sandy Cambi/Luvi/Acrisols: 331
- Farming system: Rice-Coconut-Cassava
- Farming system group: 2j1
- Topography: undulating, dissected
- Proportion of cultivated land: very high; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: moderate; Length of growing season: <3-4.5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, acidity, low organic matter content

GNEISS (Gn)

Agro-ecological zones Gn-1a, 1b, Gn-2, Gn-3, Gn-4, Gn-5a, 5b, 5c, Gn-6a, 6b and Gn-7.

Areas underlain by **gneiss**.

General description:

- Climatic range: A-E, monomodal (south), transitional and bimodal (north)
- Temperature range: 1-2, cool to intermediate temperatures
- Growing season range: very variable
- Drought risk: very variable, related to total annual rainfall. Low risks in higher rainfall areas, moderate risks in areas with average annual rainfall of 500-700 mm and high to very high risks in areas with less than 500 mm average annual rainfall.
- Soil groups: 3 and 5
- Farming system groups: 2a1, 2c2, 2f1
- Land use density: moderate to very high, unless in driest parts
- Carrying capacity: variable according to rainfall conditions
- Major cash crops: coffee, banana, tea, horticulture, fingermillet, wheat, sisal
- Major food crops: maize, bean, potato, sorghum, pigeon pea
- Occurring in SH (Rukwe, Mbeya, Iringa, Ruvuma), EZ, NZ, CZ, Tarime (LZ)

Sub-division

	Rungwe highlands, N-Mbeya and Mbozi rocky terrain	Eastern Iringa highlands, Mahenge highlands, Usambara highlands, Morogoro highlands, Matengo highlands, Wino ward, Ludewa plateau, Mbinga area, Lupembe-Niave hills, Songea plateau, Madaba-Mahanje area, Ruhuhu escarpment, Mufindi/Kidugala plateau, (east) Njombe/N+E Ubena plateau, Pare mountain, Mpwapa plateau, Upper Lukosi valley, lower plateau, Usanga flat border, Iringa plain, various shallow soil areas in Southern highlands	Kilosa-Mpwapa, E-Mbulu, E-Handeni and N-Morogoro hilly plains, Babati-Kondoa-Kibaya-W-Handeni area, Pare/Usambara footslopes, Northern lowlands, Kiteto, W-Mbulu, N-lake Eyasi, N-Irambu, N-Lushoto
Physiographic units	HP6, HU2	EF, EI2, EM2,4-5, EPh6, HM1-5, HP1-2,4, HU1, NP1-2	EH1-2, EM1,3, EPa1-2, EPh1, HM3-5, NP2, PH2, PPw1
CMU	D6d	B5(h), D4, D5(d)	C4(d,h), C6h, H5h
Farming system group	2a1	2c2	2f1
Soil group	3	5a	5b
Geology	Gneiss	Gneiss	Gneiss
	Ubendian	Mocambique, Ubendian	Basement complex, Mocambique, Dodoma, Sub-recent 2
Annual rainfall	> 800	500-1600	400-1000
Altitude (m)	nd	500-2500	750-1500
Climate/temperature regime	A2-B1,2	A1,2-B1,2-C1-D1	B2-C2-D1,2-E2
Crops	Coff-ban-mai	Coff-mai-bean-pot-sorg-f.mil	Coff-mai-bean-sorg-wheat-ppa-past

Average annual rainfall more than 1000 mm and up to 1300 to 2000 mm, monomodal pattern, low drought risk, intermediate to cool to very cool conditions

Agro-ecological zone	Gn-1a	Gn-1b	
Temperature regime	(Very) cool	Intermediate to cool	
Growing season	> 6-8+	> 5-7+	
Land use density	nd	Moderate to very high	
Carrying capacity	nd	Moderate to high	
Major crops	Coff,ban	Mai,bean,pot,coff,tea,hort	
Soil moisture dependency	nd	Low to high	
Mapping units	Alh3	A1d1-7, A1j1-3	

Average annual rainfall more than 1000 mm and up to 1000/2600 mm, intermediate to warm conditions

Agro-ecological zone		Gn-2	
Drought risk		Low	
Rainfall pattern		Monomodal	
Temperature regime		Intermediate to warm	
Growing season		> 4-5 to 9	
Land use density		Moderate to very high	
Carrying capacity		High	
Major crops		Mai,bean,pot,cash	
Soil moisture dependency		High	
Mapping units		A2d1-3, A2d5-7	

Average annual rainfall more than 800 mm and up to 1200/1400 mm, monomodal pattern, low drought risk

Agro-ecological zone		Gn-3	
Temperature regime		Cool	
Growing season		> 5-9+	
Land use density		Moderate to very high	
Carrying capacity		Low to moderate	
Major crops		Mai,bean,pot,coff,ban,tea	
Soil moisture dependency		Moderate to high	
Mapping units		B1b1-6, B2c, B2i	

Average annual rainfall more than 700 mm and up to 900/1300 mm with variable drought risk

Agro-ecological zone			Gn-4
Drought risk			Moderate
Rainfall pattern			Trans
Temperature regime			Intermediate (to cool)
Growing season			3-4.5 to 6
Land use density			Moderate
Carrying capacity			Moderate
Major crops			Coff,mai,bean,ban
Soil moisture dependency			Moderate
Mapping units			B2p2

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone	Gn-5a	Gn-5b	Gn-5c
Drought risk	Low	Moderate	Moderate
Rainfall pattern	Mono	Mono	Trans
Temperature regime	Cool	Intermediate to cool	Intermediate to cool
Growing season	6-9	5-7	5-7
Land use density	nd	Moderate to high	nd
Carrying capacity	nd	Low to moderate	nd
Major crops	Mai	Mai,bean,sorg,f.mil	Mai,sorg,past
Soil moisture dependency	nd	Moderate to high	nd
Mapping units	C1b	C1d1-3	C2b

Average annual rainfall more than 500 mm with higher drought risk

Agro-ecological zone		Gn-6a	Gn-6b
Drought risk		Moderate	Moderate to high
Rainfall pattern		Mono	Bi-trans
Temperature regime		Cool	Cool (to intermediate)
Growing season		5-6	2/3 to 4.5/5
Land use density		High	Moderate
Carrying capacity		Low	Low
Major crops		Mai,bean,sorg,f.mil	Mai,bean,wheat,ppea,sorg,sisal,past
Soil moisture dependency		Moderate	Low
Mapping units		D1b1-2	D1d1-2, D2a1, D2e, D2g, D2k4, D2m1-2

Average annual rainfall more than 400 and up to 600/800 mm, semi-arid to arid conditions, intermediate temperature conditions

Agro-ecological zone			Gn-7
Drought risk			High to very high
Rainfall pattern			Bi-Mono
Land use density			Low to very low
Carrying capacity			Very low
Land use			Pastoralism, park
Soil moisture dependency			Low
Mapping units			Eb1-2, Ec2, Ed1

Soil types specific per farming system group or soil group

Very shallow soils (Lithosols)	111	111	111
Shallow soils		146	131
Mod. well dr. Fluvisols		(208)	
Phaeozem/Cambisols		(237)	231, 237
Humic Nitisols	275	272, 273	272, 273
Well dr. sandy Acric/Luvisols		(332,335),338	335, 338
Rhodic Ferralsols	364	362, 363	362, 363
Mod. leached, well dr. Luvi/Acric/Cambisols		412, 421	412, 421
Strongly leached Paleosols and Ferralsols/Acrisols	473	461, 473	461
Arenosols		(501)	(501)
Poorly dr.		(649)	

Fluvisols			
Mod. leached Gleysols	682		(691)
Vertisols			735
Solonetz-Solonchak			(763)

Constraints:

- Low radiation and temperatures at higher elevations
- Erosion and land slide hazard: high to very high in A climatic zones and high in B climatic zones
- Fertility, acidity (and some leaching) in A and B climatic zones, possibly low organic matter in sandy soils
- Soil depth,
- Drought in several areas, especially in D climatic zones with a relatively high dependence on soil moisture
- Workability in heavier textured soils
- Soil degradation (gully erosion), including surface capping in D and E climatic zones
- Salinity and Sodicity in drier (D and E climatic) areas

Descriptions of the different agro-ecological zones

Gn-1a

Rungwe highlands

- Associated zone: Gn-5a
- Mapping unit: Alh3
- Geology, parent material: Ubendian gneiss
- Climatic zones: A, monomodal; Temperature regime: 1
- Soil group: 3; Soil types: Humic Nitisols: 275; Rhodic Ferralsols: 364
- Farming system: Coffee-Banana (2), maize, potato
- Farming system group: 2a1
- Topography: steep hills and footslopes ?
- Proportion of cultivated land: nd; Carrying capacity: nd
- Dependency on soil available moisture: nd; Drought risk: low; Length of growing season: nd
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, erosion, acidity

Gn-1b

Eastern Iringa highlands, Mahenge highlands, Usambara highlands, Morogoro highlands, Matengo highlands, Wino ward, Ludewa plateau

- Associated zones: Gn-2, 3, 5b, 6a
- Mapping units: Ald1, Ald2, Ald3, Ald4, Ald5, Ald6, Ald7, Alj1, Alj2, Alj3
- Geology, parent material: gneiss (Mocambique, Ubendian)
- Climatic zones: A, monomodal, transitional and bimodal, 1000-1600 mm annual rainfall; Temperature regime: 1-2, 500-2800 m altitude
- Soil group 5a; Soil types: Very shallow Lithosols: 111; Shallow Phaeozem/Calcisols: 146 (Ald1); Humic Nitisols: 272; Rhodic Ferralsols: 362? and 363; Moderately leached Luvi/Acri/Cambisols: 412 (Ald6, Ald7); Strongly leached Paleosols: 461 (Ald4)
- Farming systems: Maize-Bean (2), Maize-Potato (2), Maize-Forestry (1a), Coffee-Maize-Bean (3a)(Alj1), tea estates
- Farming system group: 2c2

- Topography: (strongly) dissected, undulating to rolling to hilly, mountaineous
- Proportion of cultivated land: medium to very high; Carrying capacity: low to high
- Dependency on soil available moisture: low to high; Drought risk: low to moderate; Length of growing season: 5-7, up to 9 and more months
- Constraints:
 - Climatic: radiation, temperature, drought
 - Soils: erosion, fertility, workability, acidity, soil depth, , landslides, capping/surface sealing

Gn-2

Mbinga area, Lupembe-Niave hills, Songea plateau, Madaba-Mahanje area, Ruhuhu escarpment

- Associated zones: Gn-1b, 3, 5b, 6a
- Mapping units: A2d1, A2d2, A2d3, A2d5, A2d6, A2d7
- Geology, parent material: gneiss (Mocambique)
- Climatic zones: A, monomodal, possibly transitional, 1000-1600 mm annual rainfall; Temperature regime: (1-)2, 500-1600 m altitude
- Soil group: 5a; Soil types: Very shallow Lithosols: 111; Humic Nitisols: 272 (A2b1); Rhodic Ferralsols: 362+363; Moderately leached Luvi/Acri/Cambisols: 412 and 421
- Farming systems: Maize-Bean (2), Maize-Potato (2), Maize-Forestry (1a) or Cashew (1)
- Farming system group: 2c2
- Topography: (strongly) dissected, undulating to rolling to hilly
- Proportion of cultivated land: medium to very high; Carrying capacity: high
- Dependency on soil available moisture: high; Drought risk: low to moderate; Length of growing season: 5-7 or up to 9 months
- Constraints:
 - Climatic: drought, radiation
 - Soils: fertility, acidity, erosion, workability, landslides, soil depth, capping/surface sealing

Gn-3

Mufindi, Kidugala plateaux, east Njombe plateau, Pare mountain, Mpwapwa plateau, Eastern and Northern Ubena plateaux, Shallow soil areas (Lower Livingstone mountains, Lake Tanganyika escarpment, Ruhudji hills), Chimala scarp, Numbe mountains, Northern Gofio plateau

- Associated zones: Gn-1b, 2, 5b, 6a
- Mapping units: B1b1, B1b2, B1b3, B1b4, B1b5, B1b6, B2c, B2i
- Geology, parent material: gneiss (Mocambique)
- Mapping unit B2i is yet unclear. It is either:
 - H6 (HP4) on AEZ-map in the Mbeya highlands with P14 as parent material. AEZ would be in between A1b and C1a
 - H1 (according to AEZ-SH with gneiss as parent material, comparable to C1d1-3 with soil types 272, 111 and possibly 473. AEZ would be C1c (soil group 5a, FSG 2c2)
- Climatic zones: B, monomodal, possibly transitional, 800-1300 mm annual rainfall; Temperature regime: 1-2, 500-2300 m altitude
- Soil group: 5a; Soil types: Very shallow Lithosols: 111; Humic Nitisols: 272; Sandy Acrisols: 338 (B1b4); Rhodic Ferralsols: 363

- (B1b3); Well drained strongly leached Paleosols: 461 (B1b4); Strongly leached Ferralsol/Acrisols: 473
- Farming systems: Maize-Bean (2), Maize-Potato (2), Coffee-Banana (2), tea and wattle estates
- Farming system group: 2c2
- Topography: undulating to rolling to hilly to mountaineous, locally strongly dissected
- Proportion of cultivated land: medium to very high; Carrying capacity: low to medium
- Dependency on soil available moisture: moderate to high; Drought risk: low to moderate; Length of growing season: 5-9+ months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, soil depth (drought stress), low organic matter, erosion, workability, acidity, capping/surface sealing

Gn-4

Kilosa-west and Mpwapwa medium altitude plains

- Associated zones: Gn-5c, 6b, 7
- Mapping unit: B2p2
- Geology, parent material: gneiss (Mocambique)
- Climatic zones: B, transitional?, 800-1000 mm annual rainfall; Temperature regime: 2, 750-1500 m altitude
- Soil group: 5b; Soil types: Humic Nitisols: 272; Sandy Acrisols: 338; Well drained strongly leached Paleosols: 461
- Farming systems per climatic zone: Coffee-Maize-Bean (3b)
- Farming system group: 2f1
- Topography: dissected, flat to rolling
- Proportion of cultivated land: medium; Carrying capacity: moderate
- Dependency on soil available moisture: moderate; Drought risk: moderate; Length of growing season: 3-5 months
- Constraints:
 - Climatic: drought
 - Soils: erosion, fertility, acidity, low organic matter content, capping/surface sealing, soil degradation (gully erosion)

Gn-5a

North Mbeya and Mbozi rocky terrain

- Associated zone: Gn-1a
- Mapping unit: C1b
- Geology, parent material: Ubendian gneiss
- Climatic zones: C, monomodal, 800 mm annual rainfall; Temperature regime: 1
- Soil group: 3; Soil types: Very shallow Lithosols: 111; Well drained strongly leached Ferralsol/Acrisols: 473
- Farming system: Maize-Forestry (1b)
- Farming system group: 2a1
- Topography: steep hills and footslopes
- Proportion of cultivated land: nd; Carrying capacity: nd
- Dependency on soil available moisture: nd; Drought risk: low; Length of growing season: nd
- Constraints:
 - Climatic: drought
 - Soils: erosion, fertility, low organic matter content, soil depth (drought stress), capping/surface sealing

Gn-5bUpper Lukosi valley, lower Mufindi plateau and Usanga flat border

- Associated zones: Gn-1b, 2, 3, 6a
- Mapping units: C1d1, C1d2, C1d3
- Geology, parent material: gneiss (Mocambique)
- Climatic zones: C, monomodal, 900 mm annual rainfall; Temperature regime: 1-2, 1000-1800 m altitude
- Soil group: 5a; Soil types: Very shallow Lithosols: 111; Humic Nitisols: 272; Well drained strongly leached Ferralsol/Acrisols: 473
- Farming systems: Sorghum-Finger millet (1), Maize-Bean (4a)
- Farming system group: 2c2
- Topography: undulating to hilly
- Proportion of cultivated land: medium to high; Carrying capacity: low to moderate
- Dependency on soil available moisture: moderate to high; Drought risk: moderate; Length of growing season: 5-7 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, soil depth (drought stress), low organic matter, erosion, soil degradation (gully erosion), capping/surface sealing

Gn-5cEast Handeni, North Morogoro hilly plains

- Associated zones: Gn-4, 6b, 7
- Mapping unit: C2b
- Geology, parent material: gneiss (Mocambique)
- Climatic zones: C, transitional, 600-1000 mm annual rainfall; Temperature regime: 1-2, 750-1500 m altitude
- Soil group: 5b; Soil types: Phaeozems/Cambisols: 237; Rhodic Ferralsols: 363; Moderately leached Luvi/Acri/Cambisols: 412; Well drained strongly leached Paleosols: 461
- Farming system: Maize-Sorghum-(agro-)Pastoralism (1a)
- Farming system group: 2f1
- Topography: hilly
- Proportion of cultivated land: nd; Carrying capacity: nd
- Dependency on soil available moisture: nd; Drought risk: moderate; Length of growing season: nd
- Constraints:
 - Climatic: drought
 - Soils: erosion, fertility, low organic matter content, soil degradation (gully erosion), capping/surface sealing

Gn-6aIringa plain

- Associated zones: Gn-1b, 2, 3, 5b
- Mapping units: D1b1, D1b2
- Geology, parent material: gneiss (Mocambique)
- Climatic zones: D, monomodal, 600-900 mm annual rainfall; Temperature regime: 1, 1500-2000 m altitude
- Soil group: 5a; Soil types: Very shallow Lithosols: 111; Humic Nitisols: 272; Well drained strongly leached Ferralsol/Acrisols: 473

- Farming systems: Maize-Bean (4a) and Sorghum-Fingermillet (1)
- Farming system group: 2c2
- Topography: undulating
- Proportion of cultivated land: high; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: moderate; Length of growing season: 5-6 months
- Constraints:
 - Climatic: drought, temperature?
 - Soils: fertility, soil depth (drought stress), low organic matter?, capping/surface sealing, salinity?, soil degradation (gully erosion)

Gn-6b

Babati-North Kondoa, Kondoa-Kibaya-West Handeni, Pare footslopes, Northern lowlands, East Mbulu

- Associated zones: Gn-4, 5c, 7
- Mapping units: D1d1, D1d2, D2a1, D2e, D2g, D2k4, D2m1, D2m2
- Geology, parent material: gneiss (Mocambique, Sub-recent (2) materials)
- Climatic zones: D, bimodal-transitional, 500-800/1000 mm annual rainfall; Temperature regime: 1-2, 500-2500 m altitude
- Soil group: 5b; Soil types: Shallow Phaeozem/Calcisols: 131; Phaeozems/Cambisols: 231 (D2k4); Humic Nitisols: 273?; Rhodic Ferralsols: 362 (D2m1); Moderately leached Luvi/Acri/Cambisols: 412 (D2m1, D2m2), 421; Well drained strongly leached Paleosols: 461
- Farming systems: Maize-Bean (5a, 5b), Wheat-Barley-Maize-Bean-Pigeon pea, Maize-Sorghum-Pastoralism (3), sisal and bean estates
- Farming system group: 2f1
- Topography: (strongly) dissected and flat to (gently) undulating to rolling
- Proportion of cultivated land: medium to high; Carrying capacity: low to very low
- Dependency on soil available moisture: low to high; Drought risk: moderate to high; Length of growing season: 2-2.5/5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, salinity, soil degradation (gully erosion), capping/surface sealing, workability

Gn-7

Kiteto, North Lushoto, North Monduli, North Lake Eyasi, West Mbulu, North Irambu steppes

- Associated zones: Gn-4, 5c, 6b
- Mapping units: Eb1, Eb2, Ec2, Ed1
- Geology, parent material: gneiss, granite (Mocambique, Basement complex, Dodoma)
- Climatic zones: E, bimodal to monomodal, 400-600 mm annual rainfall; Temperature regime: 2, 1000-1500 m altitude
- Soil group: 5b; Soil types: Very shallow Lithosols: 111; Sandy Luvisols: 335 (Ed1); Moderately leached Luvi/Acri/Cambisols: 421 (Ed1); Strongly leached Paleosols: 461 (Eb1)
- Farming system/land use system: Pastoralism (2b, Park (1c)
- Farming system group: 2f1
- Topography: (gently) undulating

- Proportion of cultivated land: low to very low; Carrying capacity: very low
- Dependency on soil available moisture: low; Drought risk: low to high, could be high to very high; Length of growing season: < 2 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, sodicity, soil degradation (gully erosion), capping/surface sealing

KAGERA-KIGOMA METAMORPHIC AND SEDIMENTARY ROCKS (BUKOBAN AND KARAGWE-ANKOLEAN) (Ka)

Agro-ecological zones Ka-1, Ka-2, Ka-3a,3b and Ka-4a, 4b, 4c.

Area covered by **Bukoban and Karagwe-Ankolean metamorphic and sedimentary rocks**, including the floodplain of the Kagera river.

General description:

- Climatic range A-B, bimodal (north) to monomodal (south)
- Temperature range: 1-2, cool to intermediate
- Growing season range: 4-9 and more months
- Drought risk: generally low
- Soil groups: 7, 10, 29
- Farming system groups: 1a2, 1d1, 1f3, 2b1, 2b2, 2h1
- Land use density: usually high and in some areas very high; in drier parts lower densities
- Carrying capacity: generally moderate
- Major cash crops: coffee, bean, tea, dairy, sugarcane
- Major food crops: banana, maize, cassava, rice

Sub-division

- Ka-I, Western Kagera, Kigoma
- Ka-II, Eastern Kagera, SH (Rukwa)

	Kasuli-Kibombo	Kigoma highlands, Karagwe plains and hills	Kagera floodplain	Bukoba high rainfall area, Nkansi-Kasanga plain, Kigoma lakeshore, Katumba plateau, Busando hills, C-Biharamulo, SE-Kagera
Physiographic units	W1	W2-3	W8-9	PC1, 3?, 4, PPw5, U2, 4, W4, 6, 7
CMU	C1h	D1, D3(d)	H2	C2(h), D2, G4(h)
Farming system groups	1d1	2b2, 1a2	2h1	2b1, 1f3
Soil group	7b	7a, 7c	10	29
Geology	Basalt, limestone, sandstone	Phyllite, quartzite, sandstone, limestone	Stream deposits	Sandstone, shale, quartzite
	Bukoba (1)	karagwe-Ankolean (2), Bukoba (2)	Sub-recent (2)	Bukoba (2)
Annual rainfall	800-1400	800-1500	700-1500	800-1300
Altitude (m)	1000-1500	1300-1800	1000-1500	800-1800
Climate/temperature regimes	B1	A1-B2	B2-D2	A2-B1,2
Crops	Mai-bean	Coff-mai-bean-ban	Mai-dairy	Coff-ban-cass-rice-tob-past

Average annual rainfall more than 1000 mm and up to 1300 to 2000 or more mm, monomodal pattern, low drought risk, intermediate to cool or very cool conditions

Agro-ecological zone		Ka-1		
Temperature regime		(Very) cool		
Growing season		6-8		
Land use density		High		
Carrying capacity		Moderate		
Major crops		Coff, mai, bean		
Soil moisture dependency		Moderate		
Mapping units		Ale, Alf		

Average annual rainfall more than 1000 mm and up to 1000/2600 mm, intermediate to warm conditions

Agro-ecological zone				Ka-2
Drought risk				Low
Rainfall pattern				Bimodal
Temperature regime				Intermediate
Growing season				> 7
Land use density				High to very high
Carrying capacity				Moderate
Major crops				Coff,ban,tea
Soil moisture dependency				Low to moderate
Mapping units				A2a1-2

Average annual rainfall more than 800 mm and up to 1200/1400 mm, monomodal pattern, low drought risk

Agro-ecological zone	Ka-3a			Ka-3b
Temperature regime	Cool			Cool
Growing season	6.5-8			> 5-8/9?
Land use density	High			nd
Carrying capacity	Moderate			nd
Major crops	Mai,bean			Cass,rice
Soil moisture dependency	Moderate			nd
Mapping units	Ble			B1f

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone		Ka-4a	Ka-4b	Ka-4c
Drought risk		Low	Low	Low
Rainfall pattern		Bi (-trans)	Bi	Trans-mono
Temperature regime		(intermediate to) cool	Intermediate to cool	Intermediate
Growing season		7-9	> 4	4-5 to 7.5
Land use density		High	High to very high	Low to very high
Carrying capacity		Moderate	Moderate	Low to moderate
Major crops		Ban,coff	Mai,dairy,s/cane	Coff,ban,cass,rice,tob,past
Soil moisture dependency		Low to high	Low	Moderate
Mapping units		B2g1-2	B2e1, D2p3	B2f1-4, B2t

Soil types specific per farming system group or soil group

Very shallow soils (Lithosols)	(113)	106, 108, (114), 116		106, 108
Mod. well dr. Fluvisols			202, 203	
Humic Nitosols	276	276		
Well dr. sandy Luvi/Acri/Cambisols				341
Clayey and loamy Ferralsols	367	365, 367		368, 391
Mod. leached well dr. Luvi/Acri/Cambisols				421, 424
Str. leached well dr. Ferralsols/Acrisols		479		473, 477
Arenosols				506
Hardpan soils			(604)	
Poorly dr. Fluvisols			642, 652	634, (651)
Mod. leached	(687)	(684-7)		686

Gleysols				
Humic/Dystric Gleysols			704	704
Vertisols			(728)	
Histosol		(786)	787	784

Constraints:

- Radiation, temperature at higher elevations
- Soil depth, very shallow soils
- Erosion, high to very high in A and high in B climatic zones
- Leaching, especially with annual rainfall more than 1200 mm
- Fertility, especially low in light textured soils and in high rainfall zones
- Acidity, important in high rainfall (A) zones (esp. subsoils)
- Drought plays a minor role in the drier areas
- Flooding and drainage problems in the valleys and floodplains

Descriptions of the different agro-ecological zones

Ka-1

Kigoma highlands

- Associated zones: Ka-3a, Ka-4a
- Mapping units: Ale, Alf
- Geology, parent material: sandstone, limestone, basalt, phyllite, quartzite (Bukoba (2), Karagwe/Ankolean (2))
- Climatic zones: A, monomodal, 1000-1500 mm annual rainfall; Temperature regime: 1, 1500-1700 m altitude
- Soil groups: 7a, 7c; Soil types: Very shallow Lithosols: 108; 116; Humic Nitisols: 276; Ferralsols: 365; 367; Strongly leached Ferralsol/Acrisols: 479
- Farming system: Coffee-Maize-Bean (2)
- Farming system group: 1a2, 2b2
- Topography: dissected and hilly
- Proportion of cultivated land: high; Carrying capacity: medium
- Dependency on soil available moisture: moderate; Drought risk: low; Length of growing season: 6-8 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, acidity, erosion, leaching, soil depth, capping/surface sealing

Ka-2

Bukoba high rainfall area

- Associated zones: Ka-3b, Ka-4c
- Mapping units: A2a1, A2a2
- Geology, parent material: sandstone and shale (Bukoba (2))
- Climatic zones: A, bimodal, 1000-2000 mm annual rainfall; Temperature regime: 2, 1200-1600 m altitude
- Soil group: 29a; Soil types: Very shallow Lithosols: 108; Moderately leached sandy Luvi/Acri/Cambisols 341; Clayey Ferralsols: 368; 391; Humic/Dystric Gleysols: 704; Histosols: 784
- Farming system: Coffee-Banana (3), tea estates
- Farming system group: 2b1
- Topography: undulating to rolling, some dissection
- Proportion of cultivated land: high to very high; Carrying capacity: medium

- Dependency on soil available moisture: low to moderate; Drought risk: low; Length of growing season: 7+ months
- Constraints:
 - Climatic: radiation?
 - Soils: fertility, acidity, drainage, leaching, soil depth, erosion

Ka-3a

Kasuli-Kibombo medium altitude plains

- Associated zones: Ka-1a, Ka-4a
- Mapping unit: Ble
- Geology, parent material: sandstone, limestone, basalt (Bukoba (1))
- Climatic zones: B, monomodal (to transitional), 800-1400 mm annual rainfall; Temperature regime: 1(-2), 1000-1500 m altitude
- Soil group: 7b; Soil types: Humic Nitisols: 276; Ferralsols: 367;
- Farming system: Maize-Bean (3)
- Farming system group: 1d1
- Topography: dissected, rolling to hilly
- Proportion of cultivated land: high; Carrying capacity: medium
- Dependency on soil available moisture: moderate; Drought risk: low; Length of growing season: 6.5-8 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: erosion, fertility, soil depth (drought stress)

Ka-3b

Nkansi-Kasanga plain

- Associated zones: Ka-2, Ka-4c
- Mapping unit: Blf
- Geology, parent material: sandstone and shale (Bukoba (2))
- Climatic zones: B, monomodal, 900-1200 mm annual rainfall; Temperature regime: 1(-2?), 1000+ m (?) altitude
- Soil group: 29a; Soil types: Well drained strongly leached Ferralsol/Acrisols: 477
- Farming system: Cassava-Rice
- Farming system group: 2b1
- Topography: gently undulating to rolling, some dissection
- Proportion of cultivated land: nd; Carrying capacity: nd
- Dependency on soil available moisture: nd; Drought risk: low?; No data on length of growing season
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, erosion, capping/surface sealing

Ka-4a

Karagwe plains and hills

- Associated zones: Ka-1a, Ka-3a
- Mapping units: B2g1, B2g2
- Geology, parent material: phyllite, quartzite, Karagwe/Ankolean (2))
- Climatic zones: B, bimodal (to transitional), 800-1000 mm annual rainfall; Temperature regime: 1(-2), 1300-1800 m altitude
- Soil group: 7c; Soil types: Very shallow Lithosols: 106; 108; 116?; Ferralsols: 365

- Farming systems: Banana or Coffee-Banana (3)
- Farming system group: 2b2
- Topography: undulating to rolling, strongly dissected
- Proportion of cultivated land: high; Carrying capacity: medium
- Dependency on soil available moisture: low to high; Drought risk: low; Length of growing season: 7-9 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, soil depth (drought stress), erosion

Ka-4b

Northern Kagera floodplain and along Ruanda border

- Mapping units: B2e1, D2p3
- Geology, parent material: stream deposits (Sub-recent (2))
- Climatic zones: B-D, bimodal pattern, 700-1500 mm annual rainfall; Temperature regime: 2, 1000-1500 m altitude
- Soil group: 10; Soil types: Well drained Fluvisols: 202+203; Poorly drained Fluvisols: 652; Humic/Dystric Gleysols: 704; Histosols: 787
- Farming system: Maize-Livestock (1a, 1c), sugarcane estate
- Farming system group: 2h1
- Topography: flat floodplains and undulating to rolling and ridges in surroundings
- Proportion of cultivated land: high to very high; Carrying capacity: medium
- Dependency on soil available moisture: low; Drought risk: low; Length of growing season: more than 4 months
- Constraints:
 - Climatic: radiation?
 - Soils: flooding, fertility, acidity

Ka-4c

Kigoma lakeshore, Katumba plateau, Busando hills, Central Biharamulo, SW Kagera

- Associated zones: Ka-2, Ka-3b
- Mapping units: B2f1, B2f2, B2f3, B2f4, B2t
- Geology, parent material: sandstone and shale (Bukoba (2) (and Ubendian gneiss))
- Climatic zones: B, monomodal to transitional, 800-1300 mm annual rainfall; Temperature regime: (1-)2, 800-1800 m altitude
- Soil groups: 29a, 29b; Soil types: Sandy Luvi/Acri/Cambisols: 341 (ass. with 477); Arenosols: 506; Clayey Ferralsols: 364; 368; Loamy Ferralsols: 391; Moderately leached Luvi/Acri/Cambisols: 421; Strongly leached Ferralsol/Acrisols: 473; 477; Humic/Dystric Gleysols: 704; Histosols: 784
- Farming systems: Coffee-Banana (3), Tobacco-(agro-)Pastoralism (1a), Banana, Cassava-Rice-Oilpalm
- Farming system groups: 1f3, 2b1
- Topography: gently undulating to rolling to hilly some dissection
- Proportion of cultivated land: low to very high; Carrying capacity: low to medium
- Dependency on soil available moisture: moderate; Drought risk: low; Length of growing season: 4-5/7.5 months
- Constraints:
 - Climatic: drought, radiation, humidity
 - Soils: fertility, acidity, erosion?, capping/surface sealing

LACUSTRINE SEDIMENTS IN LAKE, NORTHERN AND SOUTHERN HIGHLANDS ZONES (La)

Agro-ecological zones La-1, La-2, La-3 and La-4a,4b.

Area covered by **lacustrine, wash and alluvial deposits.**

General description:

- Climatic range: B-E, monomodal (south) to transitional (northern) and locally bimodal
- Temperature range: 2, intermediate temperatures
- Growing season range: 3-9 months
- Drought risk: low to moderate, but up to very high in bimodal rainfall pattern
- Soil groups; 8 and 11
- Farming system groups: 212, 201
- Land use density: generally low, but higher with irrigation possibilities
- Carrying capacity: low to moderate
- Major cash crops: rice, tobacco, cotton, livestock
- Major food crops: maize, sorghum, rice

Sub-division:

- La-I, Lake zone, Lake Manjara, Igunga (WZ), Lake Natron
- La-II, SH (Rukwa), Usanga, Nduki (Iringa)

	Itogolo-dominated Sukumaland, Ibushi plain, E-Lake Manjara shore, Shinyanga-Igunja area, lake Natron shore	Rukwa valley, Rukwa/Songwe valley, Nduli-Ismani flats, Usanga plain, Ruaha lowland/valley
Physiographic units	NR1-2, PPs1, PPw4	RA1-6, RP3
CMU	H3, H4	G2
Farming system group	212	201
Soil group	8	11
Geology	Wash, lake, stream deposits	Stream, lake deposits
	Plio-Pleistocene 3, maybe Pleistocene 3	Recent 2
Annual rainfall	1000-1300	400-1200
Altitude (m)	400-800	700-1500
Climatic/temperature range	B2-D2-E2	C2-E2
Crops	Rice-live-cot-sorg-past	Tob-mai-sorg-rice-past

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone	La-1	
Drought risk	Moderate	
Rainfall pattern	Trans	
Temperature regime	Intermediate	
Growing season	3-4.5-6?	
Land use density	Unclear	
Carrying capacity	Low?	
Major crops	Rice, live	
Soil moisture dependency	Low to very low	
Mapping units	B212	

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone		La-2
Drought risk		Low
Rainfall pattern		Mono
Temperature regime		Intermediate
Growing season		5-9
Land use density		Low (Moderate ?)
Carrying capacity		Moderate
Major crops		Tob, mai, sorg, past
Soil moisture dependency		High
Mapping units		C2c1-3

Average annual rainfall more than 500 mm with higher drought risk

Agro-ecological zone	La-3	
Drought risk	Low to moderate	
Rainfall pattern	Mono-trans	
Temperature regime	Intermediate	
Growing season	3-3.5	
Land use density	Very high?	
Carrying capacity	Very low?	
Major crops	Cot, sorg, past	
Soil moisture dependency	Low	
Mapping units	D2o1-3	

Average annual rainfall more than 400 mm and up to 600/800 mm, semi-arid to arid conditions, intermediate temperature conditions

Agro-ecological zone	La-4b	La-4a
Drought risk	High to very high	Low
Rainfall pattern	Bi	Mono
Growing season	nd	3-5
Land use density	Very low	Low
Carrying capacity	nd	Very low to moderate
Major crops	Past	Mai, sorg, rice, past
Soil moisture dependency	nd	Low
Mapping units	Eg2	Eel-4

Soil types specific per farming system group or soil group

Very shallow soils (Lithosol/Regosol)		109
Mod. well dr. Fluvisols		204, (207)
Luvic Phaeozems	234, 238, (240)	
Well dr. sandy Luvi/Acri/Cambisols		335, 343, 344
Mod. leached, well dr. Luvi/Acri/Cambisols		414, 425
Str. leached, well dr. Paleosols	462	
Arenosols		509
Hardpan soil	602	605
Poorly dr. Fluvisols		634, 647
Mod. leached Gleysols		672, 673
Vertisols	728, 731	(729), 730
Solonetz, Solonchak	(765), 771	767

Constraints:

- Erosion and soil degradation in D and E climatic zones, possibly locally in B- and C-climatic zones
- Sodidity and salinity constraints especially in E climatic zones
- Flooding and drainage problems occurring in alluvial flats
- Fertility, especially in light textured soil types
- Workability in heavy textured and sodic soils
- Drought

Descriptions of the different agro-ecological zones

La-1

Itogolo soil type dominated areas in E-Sukumaland

- Associated zones: La-3, La-4a
- Mapping unit: B2l2
- Geology, parent material: wash, lake and stream (Plio-)Pleistocene (3) deposits covering marl, sand, clay and granite
- Climatic zones: B, transitional, 800-1000 mm annual rainfall; Temperature regime: 2, 1000-1200 m altitude
- Soil group: 8; Soil types: Imperfectly drained hardpan soils: 602 dominant; Imperfectly to poorly drained Vertisols: 728;
- Farming system: Rice-Livestock
- Farming system group: 2l2
- Topography: very gently undulating
- Proportion of cultivated land: very high (??)?? nd; Carrying capacity: very low ?
- Dependency on soil available moisture: low to very low; Drought risk: low to moderate; No data on length of growing season
- Constraints:
 - Climatic: drought
 - Soils: fertility, drainage, soil degradation (gully erosion), low organic matter content

La-2

Rukwa valley/floodplain, Rukwa/Songwe valley

- Associated zone: La-4b
- Mapping units: C2c1, C2c2, C2c3
- Geology, parent material: lake and stream deposits (Recent (2))
- Climatic zones: C, monomodal, 600-1200 mm annual rainfall; Temperature regime: 2, 800-1200 m altitude
- Soil group: 11; Soil types: Very shallow Lithosol/Regosols: 109; Sandy Luvi/Acri/Cambisols: 343; Arenosols: 509; Moderately leached Luvi/Acri/Cambisols: 414; 425; Imperfectly drained hardpan soils: 605; Imperfectly to poorly drained Vertisols: 730; Poorly drained Fluvisols: 634; Salty and/or sodic soils: 767
- Farming systems: Tobacco-(agro-)Pastoralism (1b) and Maize-Sorghum-Pastoralism (5)
- Farming system group: 2o1
- Topography: flat plains and gently undulating to rolling plains with some dissection
- Proportion of cultivated land: low; Carrying capacity: medium
- Dependency on soil available moisture: high; Drought risk: low to moderate; Length of growing season: 5-9 months
- Constraints: sodicity, flooding, salinity, fertility, soil degradation (gully erosion), low organic matter content, soil depth (drought stress), capping/surface sealing

La-3

Ibushi plain, E-Lake Manjara shore, Shinyanga-Igunja area

- Associated zones: La-1, La-4a
- Mapping units: D2o1, D2o2, D2o3
- Geology, parent material: wash, lake and stream (Plio-)Pleistocene (3) deposits covering marl, sand, clay and granite

- Climatic zones: D, monomodal (to transitional), 500-800 mm annual rainfall; Temperature regime: 2, 1000-1100 m altitude
- Soil group: 8; Soil types: Luvisols: 234+238; Strongly leached Paleosols: 462; Imperfectly drained hardpan soils: 602; Imperfectly to poorly drained Vertisols: 728+731; Salty and/or sodic soils: 771
- Farming systems: Cotton-Sorghum-Pastoralism
- Farming system group: 212
- Topography: very gently undulating
- Proportion of cultivated land: very high (?); Carrying capacity: very low ?
- Dependency on soil available moisture: low; Drought risk: low to moderate; Length of growing season: 3-3.5 months
- Constraints:
 - Climatic: drought
 - Soils: soil degradation (gully erosion), sodicity, fertility, drainage, capping/surface sealing

La-4a

Nduli-Ismani flats, Usangu plain, Ruaha lowland/valley

- Associated zone: La-2
- Mapping units: Ee1, Ee2, Ee3, Ee4
- Geology, parent material: lake and stream deposits (Recent (2))
- Climatic zones: E, monomodal, 400-600, sometimes up to 900 mm annual rainfall; Temperature regime: 2, 700-1500 m altitude
- Soil group: 11; Soil types: Sandy Luvisols/Acri/Cambisols: 335; 343?+344; Arenosols: 509; Moderately leached, (saline/sodic) Luvisols/Acri/Cambisols: 425; Well to moderately well drained Fluvisols: 204; Imperfectly drained hardpan soils: 605; Poorly drained Fluvisols: 634; 647; Salty and/or sodic soils: 767
- Farming systems: Maize-Sorghum-Pastoralism (5), Rice-Pastoralism (1) or Pastoralism (2a), including rice schemes
- Farming system group: 201
- Topography: flat to gently undulating plains
- Proportion of cultivated land: low; Carrying capacity: very low to medium
- Dependency on soil available moisture: low; Drought risk: low; Length of growing season: 3-5 months, variable
- Constraints:
 - Climatic: drought
 - Soils: workability, flooding, salinity, drainage, fertility, sodicity, soil degradation (gully erosion)

La-4b

Lake Natron shore

- Associated zones: La-1, La-3
- Mapping unit: Eg2
- Geology, parent material: lake (Plio-)Pleistocene (3) deposits covering marl, sand, clay and granite
- Climatic zones: E, bimodal, 400-500 mm annual rainfall; Temperature regime: 2
- Soil group: 8; Soil types: Salty and/or sodic soils: 771
- Farming system/land use system: Pastoralism (2b)
- Farming system group: 212
- Topography: very gently undulating
- Proportion of cultivated land: very low; Carrying capacity: nd

- Dependency on soil available moisture: nd; Drought risk: moderate to very high; Length of growing season: nd
- Constraints:
 - Climatic: drought
 - Soils: flooding, sodicity, salinity, workability, soil degradation (gully erosion)

LAKE- AND WESTERN ZONES METAMORPHIC, IGNEOUS AND SEDIMENTARY ROCKS AND PLEISTOCENE SEDIMENTS (Lw)

Agro-ecological zones Lw-1a,1b, Lw-2a,2b,2c, Lw-3a,3b.

Area covered by **metamorphic, igneous and sedimentary rocks and Pleistocene and more recent alluvial and lacustrine sediments**, including swamps and floodplains in Lake and Western zones.

General description:

- Climatic range B-D, monomodal (south) to bimodal (north)
- Temperature range: generally 2, intermediate temperatures
- Growing season range: variable between 3 and 10 months
- Drought risk: generally low
- Soil groups: 10, 13, 17, 18, 20
- Farming system groups: 1f1, 1f2, 2d1, 2h1, 2h2
- Land use density: generally low, but higher in southern and eastern Lake zone
- Carrying capacity: low to moderate
- Major cash crops: cotton, livestock, coffee, oilpalm
- Major food crops: maize, rice, groundnut, cassava, sweet potato, sorghum, bean

Sub-division:

- Lw-I, Central Kagera, Ngara
- Lw-II, Sukumaland (LZ), WZ, CZ

	Ngara, ranching area in C+N-Kagera, Karagwe (C+N-Kagera) hills and plains	Luseni/Itogolo dominated E-Sukumaland, SE-Bukombe plain, Sikonge-Misi plain, Igunga-Tabora plain, Central-Western plains on continental deposits	Western swamps	Kigoma lakeshore	Mara floodplain
Physiographic units	W4-5	PH4, PPp1-2, PPs3, PPw1, 7-8	PPp1, 3	PPw5	PR
CMU	C3h	G7, H4, H6	G1	G3	H2
Farming system group	2d1	2h2	1f1	1f2	2h1
Soil group	17	18	13	20	10
Geology	Schist, granite	Granite, wash deposits	Lake, stream deposits	Limestone, basalt	Stream deposits
	Karagwe-Ankolean 1	Pleistocene 3	Recent 2	Bukoba 1	Sub-recent 2
Annual rainfall	800	500-1000	800-1000	800-1300?	700-1500
Altitude (m)	1000-1500	1000-1400	900-1200	800-1800?	1000-1500
Climatic/temperature range	B2-D1,2	B2-D2	B2	B2	B2
Crops	Coff-mai-bean-dairy	Cot-mai-sorgh-gr/nut-past	Rice-sw.pot	Cass-rice-oilpalm	Mai-dairy

**Average annual rainfall of more than 800 mm and up to 1200/1400 mm,
monomodal pattern, low drought risk**

Agro-ecological zone			Lw-1b	Lw-1a	
Temperature regime			Intermediate	Intermediate	
Growing season			5-6	6-7.5	
Land use density			Very low	Very low	
Carrying capacity			Moderate	Low	
Major crops			Rice, sw. pot	Cass, rice, oilp	
Soil moisture dependency			Low	Moderate	
Mapping units			B2o	B2s	

**Average annual rainfall of more than 700 mm and up to 900/1300 mm
with variable drought risk**

Agro-ecological zone	Lw-2a	Lw-2c			Lw-2b
Drought risk	Low	Low to moderate			Low
Rainfall pattern	Trans	Trans (-bi or mono)			Bi
Temperature regime	Intermediate to cool	Intermediate			Intermediate to cool
Growing season	4-7/10?	3-6			> 4
Land use density	nd (high?)	Low to very high			High to very high
Carrying capacity	nd (moderate?)	Low			Moderate
Major crops	Coff, mai, bean, dairy	Cot, mai, sorg, past			Mai, dairy
Soil moisture dependency	nd (high?)	Low			Low
Mapping units	B2h	B211, B213			B2e2

**Average annual rainfall of more than 500 mm but variable, relatively
low drought risk**

Agro-ecological zone	Lw-3a	Lw-3b			
Annual rainfall	800	500-800			
Rainfall pattern	Bi	Mono(-trans)			
Temperature regime	Intermediate to cool	Intermediate			
Growing season	nd	3-5			
Land use density	High?	Very low to moderate			
Carrying capacity	Moderate?	Low to very low			
Major crops	Mai, dairy, ranching	Mai, gr/nut, sorg, live			
Soil moisture dependency	nd	Low			
Mapping units	D1c, D2d	D2r1-3			

Soil types specific per farming system group or soil group

Very shallow soils (Lithosols)	(111), 115, 116			(113)	
Mod. well dr. Fluvisols					202, 203
Well dr. sandy Luvi/Acri/Cambisols		336		337	
Clayey and loamy Ferralsols	366	382			
Mod. leached,		423			

well dr. Luvi/Acri/ Cambisols					
Str. leached, Paleosols and Ferralsol/ Acrisols		454		474	
Arenosols		502		(505)	
Hardpan soils		602			(604)
Poorly dr. Fluvisols					642, 652
Mod. leached Gleysols	(685)	(678, 690), 691	671	(687)	
Str. leached Gleysols		702	701		704
Vertisols		740	737		(728)
Histosols	(785)		783		787

Constraints:

- Radiation, humidity in high rainfall, high altitude zones
- Soil depth, very shallow soils
- Fertility
- Acidity, developing after long period of cultivation in specific soil types or probably in higher rainfall areas
- Low organic matter content in sandy soils
- Workability constraints in Vertisols
- Erosion and soil degradation in D-climates on specific soil types
- Drought in D-climates on light textured soils and in shallow soils in B- and C-climatic zones
- Flooding and drainage problems in hydromorphic soils in swamps, valleys and floodplains, but also on flats

Descriptions of the different agro-ecological zones

Lw-1a

Kigoma lakeshore

- Mapping unit: B2s
- Geology, parent material: Bukoba (1) limestone, basalt
- Climatic zone: B, monomodal, 600-1300 mm annual rainfall; Temperature regime: 2, 800-1800 m altitude
- Soil group: 20; Soil types: Sandy Luvi/Acri/Cambisols: 337; Strongly leached Ferralsol/Acrisols: 474 [This zone can also be placed in the Kagera/Kigoma metamorphic and sedimentary rocks group]
- Farming system: Cassava-Rice-Oilpalm
- Farming system group: 1f2
- Topography: undulating
- Proportion of cultivated land: very low; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: low; Length of growing season: 6-7.5 months
- Constraints:
 - Climatic: radiation, humidity
 - Soils: fertility, acidity, capping/surface sealing

Lw-1bWestern swamps

- Mapping unit: B2o
- Geology, parent material: lake and stream deposits (Recent (2))
- Climatic zones: B, monomodal, 800-1000 mm annual rainfall; Temperature regime: 2, 900-1200 m altitude
- Soil group: 13; Soil types: Moderately leached Gleysols: 671; Strongly leached Gleysols: 701; Imperfectly to poorly drained Vertisols: 737; Histosols: 783
- Farming system: Rice, sweet potato
- Farming system group: 1f1
- Topography: flat
- Proportion of cultivated land: very low; Carrying capacity: medium
- Dependency on soil available moisture: low; Drought risk: low to moderate; Length of growing season, 5-6, depending on flooding
- Constraints: flooding, drainage, fertility, acidity?

Lw-2aNgara area and Kigoma town

- Associated zone: Lw-3a
- Mapping unit: B2h
- Geology, parent material: schist and granite
- Climatic zones: B, transitional, 800-1000 mm annual rainfall; Temperature regime: 1-2, 1000-1500 m altitude
- Soil group: 17; Soil types: Very shallow Lithosols: 115; Ferralsols: 366
- Farming systems: Coffee-Maize-Bean (2) or Maize-(Dairy/Livestock)(1d)
- Farming system group: 2d1
- Topography: undulating to rolling
- Proportion of cultivated land: high ?, nd; Carrying capacity: medium, nd
- Dependency on soil available moisture: high, nd; Drought risk: low; No data on length of growing season
- Constraints: soil depth drought stress), fertility, low organic matter content, acidity

Lw-2bMara floodplain

- Mapping unit: B2e2
- Geology, parent material: stream deposits (Sub-recent (2))
- Climatic zones: B, bimodal pattern, 800-1500 mm annual rainfall; Temperature regime: 2, 1000-1500 m altitude
- Soil group: 10; Soil types: Well to moderately well drained Fluvisols: 202 and 203; Poorly drained Fluvisols: 652
- Farming system: Maize-Livestock (1b)
- Farming system group: 2h1
- Topography: flat floodplain and undulating to rolling and ridges in surroundings
- Proportion of cultivated land: high to very high; Carrying capacity: medium
- Dependency on soil available moisture: low; Drought risk: low ?; Length of growing season: more than 4 months
- Constraints: flooding, fertility, acidity

Lw-2cLuseni/Itogolo dominated E-Sukumaland, SE-Bukombe plain and Sikonge-Msisi plain

- Associated zone: Lw-3b
- Mapping units: B211, B213
- Geology, parent material: granite, gneiss and wash deposits (Pleistocene (3))
- Climatic zones: B, monomodal-transitional (to bimodal), 800-1000 mm annual rainfall; Temperature regime: 2, 1000-1200 m altitude
- Soil group: 18; Soil types: Sandy Luvi/Acri/Cambisols: 336; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 423; Arenosols: 502; Imperfectly drained hardpan soils: 602
- Farming systems: Cotton-Maize (1a), Maize-Sorghum-(agro-)Pastoralism (2)
- Farming system group: 2h2
- Topography: gently undulating to rolling
- Proportion of cultivated land: low to very high; Carrying capacity: low
- Dependency on soil available moisture: low; Drought risk: low to moderate; Length of growing season: 3-3.5 + (up to 5-6 in the southern parts?) months
- Constraints:
 - Climatic: drought
 - Soils: fertility, workability, drainage, low organic matter content, acidity, capping/surface sealing

Lw-3aCommercial ranching area (Central Kagera), Karagwe (C- and N-Kagera) plains and hills

- Associated zone: Lw-2a
- Mapping units: D1c, D2d
- Geology, parent material: schist and granite
- Climatic zones: D, bimodal, 800 mm annual rainfall; Temperature regime: 1-2, 1000-1500 m altitude
- Soil group: 17; Soil types: Very shallow Lithosols: 115; 116; Ferralsols: 366;
- Farming system: Maize-Dairy/Livestock (1d), ranching
- Farming system group: 2d1
- Topography: undulating to rolling
- Proportion of cultivated land: high; Carrying capacity: medium
- Dependency on soil available moisture: low to high; Drought risk: low to moderate; No data on length of growing season
- Constraints:
 - Climatic: drought, radiation?
 - Soils: fertility, flooding, soil depth (drought stress)

Lw-3bIgunga-Tabora plain, Central-Western plains on continental deposits

- Associated zone: Lw-2c
- Mapping units: D2r1, D2r2, D2r3
- Geology, parent material: granite, gneiss and wash deposits (Pleistocene (3))
- Climatic zones: D, monomodal (to transitional), 500-800 mm annual rainfall; Temperature regime: 2, 1100-1400 m altitude

- Soil group: 18; Soil types: Sandy Luvi/Acri/Cambisols: 336; Ferralsols: 382; Moderately leached loamy or clayey Luvi/Acri/cambisols: 423; Strongly leached loamy clayey soils: 454; Moderately leached Gleysols: 691; Strongly leached Gleysols: 702; Imperfectly to poorly drained Vertisols: 740
- Farming systems: Maize-Groundnut-Livestock or Sorghum
- Farming system group: 2h2
- Topography: gently undulating and dissected footslopes
- Proportion of cultivated land: very low to medium; Carrying capacity: low to very low
- Dependency on soil available moisture: low; Drought risk: low to moderate; Length of growing season: 3-5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, soil depth, acidity, soil degradation (gully erosion), drainage, capping/surface sealing

GNEISS, GRANITE, SCHIST (Me)

Agro-ecological zones Me-1, Me-2a,2b,2c, Me-3, Me-4a,4b,4c, Me-5a,5b,5c,5d, Me-6a,6b, Me-7.

Area covered by **gneiss, granite, schist**, including alluvial plains and valleys in Eastern zone and lake shore areas in Southern highlands

General description:

- Climatic range A-D, variable rainfall pattern
- Temperature range: 1-3, variable
- Growing season range: 2-9, variable
- Drought risk: variable and related to average annual rainfall. usually low risk with average annual rainfall of more than 800 mm, low to moderate risks between 500 and 800 mm, moderate to high risks with average annual rainfall of less than 500 mm.
- Soil groups: 9, 12, 23, 25, 26, 28
- Farming system groups: 1b1, 1c1, 1e1, 1g2, 1h1, 1h3, 2b3, 2d2, 2g1, 2m1
- Land use density: related to rainfall regime, high to very high in several areas
- Carrying capacity: low to moderate
- Major cash crops: horticulture, sesame, sisal, cotton, fingermillet, legumes, tobacco, livestock, rice, sugarcane
- Major food crops: maize, bean, cassava, rice, groundnut, sorghum, millet, legumes, sweet potato

Sub-division:

- Me-I, LZ, CZ, WZ, SH (Rukwa, Kyela, Nyasa)
- Me-II, EZ, SH
- Me-III, EZ+SZ alluvial plains

	Kyela plain	Mwese-Mpande range, Lake Nyasa and Tanganayika shores, Karema depression, Yambamrizi range, Ipumba hills, Western plateau, Inyonga and Kipembawe plains, Uriwira plain, Bukombe-Kahama plateau, Tabora plain, W-Sukumaland plains	N-Sengerema, Ukerewa island, W-Mara (?), dissected Chunya plain, Meatu-Maswa-Shinyanga area, Central-Northern plains, Chunya plain, Wago hills, Mpwapwa-E-Kondoa plains	Kate-Mwazyie hills, Nkungwe mountain, Namanyere-Laela plain
Physiographic unit	HL	PC2, PM1, PPw3, RP1, U2	EPa1-2, PH1-5, PM2, Pp2, PPs3, PPw1-3,6	HP6?, U1,3,5,6
CMU	F1	D4?, G5, G6(h)	B5h, C4(h), C5(d,h), C6(h), H5h	D3a, D6
Farming system group	1c1	1b1, 2b3	2g1	1e1, 2d2
Soil group	9	25b,c	25e	25a,d
Geology	Lake deposits	Gneiss, schist, granite	Granite, gneiss	Schist, granite, gneiss
	Recent 2	Ubendian, Karagwe-Ankolean 1	Ubendian, Dodoma, Mocambique,	Karagwe-Ankolean 1

			Basement complex	
Annual rainfall	1000-2600	900-1500	550-1300	750-2300
Altitude (m)	500	500-2500	900-1800	850-1800
Climate/temperature range	A3	A1,2-B2	A2-B2-C2-D2	B1,2-C2-D1
Crops	Rice-cocoa	Mai-bean-cass-rice-sorg	Mai-cass-cot-rice-gr/nut-tob-sorg-past	Mai-f.mil

Average annual rainfall more than 1000 mm and up to 1300 to 2000 or more mm, monomodal pattern, low drought risk, intermediate to cool or very cool conditions

Agro-ecological zone		Me-1		
Temperature regime		(Very) cool		
Growing season		6-8.5		
Land use density		Very low?		
Carrying capacity		Low		
Major crops		Mai, bean		
Soil moisture dependency		High		
Mapping units		Ali		

Average annual rainfall more than 1000 mm and up to 1000/2600 mm, intermediate to warm conditions

Agro-ecological zone	Me-2c	Me-2a	Me-2b	
Drought risk	Low	Low	Low	
Rainfall pattern	Mono	Mono	Trans-bi	
Temperature regime	Warm	Intermediate	Intermediate	
Growing season	> 8	5-7	4-5	
Land use density	Very high	High to very high	Very high	
Carrying capacity	High	Moderate to high	Low	
Major crops	Rice, cocoa	Cass, rice, mai, bean	Mai, cass, cot, rice	
Soil moisture dependency	Low	High	Low to high	
Mapping units	A3a	A2c, A2d4, A2e	A2b	

Average annual rainfall more than 800 mm and up to 1200/1400 mm, monomodal pattern, low drought risk

Agro-ecological zone				Me-3
Temperature regime				Cool
Growing season				5-9
Land use density				High (low)
Carrying capacity				Moderate
Major crops				Mai, f.mil (bean, pot, ban)
Soil moisture dependency				High
Mapping units				B1c

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone		Me-4a		
Drought risk		Low		
Rainfall pattern		Mono(-trans)		
Temperature regime		Intermediate (to cool)		
Growing season		4-6		
Land use density		Low to very high		
Carrying capacity		Low		
Major crops		Mai, bean, f.mil, gr/nut, tob, past		
Soil moisture		Low to moderate?		

dependency				
Mapping units		B2a1-2, B2d1-4, B2j1-4, B2k		

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone			Me-5a	
Drought risk			Low	
Rainfall pattern			Mono	
Temperature regime			Intermediate to cool	
Growing season			4-7	
Land use density			Low	
Carrying capacity			Moderate	
Major crops			Mai, f.mil, tob, past	
Soil moisture dependency			Moderate to high	
Mapping units			C2a1-2	

Average annual rainfall more than 500 mm but variable, relatively low drought risk

Agro-ecological zone			Me-6b	Me-6a
Annual rainfall			500-900	750-950
Rainfall pattern			Mono-trans	Mono
Temperature regime			Intermediate	Cool
Growing season			2-3.5 to 5	5-6.5
Land use density			Low, locally high	High
Carrying capacity			Low to very low	Moderate
Major crops			Mai, sorg, cot, gr/nut, past	Mai, f.mil
Soil moisture dependency			Low (variable)	High
Mapping units			D2b1-2, D2c, D2f, D2n, D2q1-4	D1a

Soil types specific per farming system group or soil group

Very shallow soils (Lithosols)		106, 111	(108), 111	111, 115
Shallow Phaeozems			131	
Mod. well dr. Fluvisols	206			210
Nitrosols		272?	(274)	
Ferric Cambisols		335, 339	335a	335, 339
Rhodic Ferralsols		364, 381	381	Rhodic Ferralsol (U3)
Mod. leached, well dr. Luvi/Acri/Cambisols		421	421	421, 422
Str. leached, well dr. Paleosols and Ferralsol/Acrisols		473, 475, 477	461, 473	(473), 475, 477
Arenosols		501, 506	501	501, 504
Hardpan soils			(603, 604)	
Poorly dr. Fluvisols	647	651		651
Mod. leached Gleysols		691	(683), 691	(685)
Str. leached Gleysols			(701)	
Vertisols		735	735, (741)	
Solonetz-Solonchak			(741)	

Second sub-division

	Kilombero valley	Mahenge basin, Mkulula valley, W-Mikumi, Kilombero-Mahenge plain, Eastern lowland footslopes, Masisi plain, Nachinwea plain, Eastern plains, Muheza plain, SE-Tunduru/Wonachinwea plain, Southern plains	Eastern alluvial plains	Rufiji valley, coastal floodplains and deltas
Physiographic unit	EA2a,b	EF, EI1, EM1, EPh1-5,7-8	CH3, CT, EA1	CF1-2
CMU	B2	B4, B5(d,h)	A2, B1	A1
Farming system group	1g2	2m1	1h1	1h3
Soil group	12	26	23	28
Geology	Stream deposits	Gneiss	Stream deposits	Stream deposits
	Pleistocene 1	Mocambique, Plio-Pleistocene 5	Sub-recent 1	Recent 1
Annual rainfall	900-1200	500-1000	800-1000	800-1200
Altitude (m)	400-600	150-1000	400-500	< 200
Climatic/temperature range	B3	B2,3-C3-D2,3	B3-C3	B3-C3
Crops	Rice-mai-cass-cot	Mai-sorg-mil-b/nut-cot-ses-leg-past	Rice-mai-sw.pot-cass-cot	Rice-mai-cass-cot?

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone	Me-4c	Me-4b		
Drought risk	Moderate	Low to moderate		
Rainfall pattern	Trans	Variable		
Temperature regime	Warm	Intermediate to warm		
Growing season	5.5-8	4/6-6/9		
Land use density	High	Moderate to (very) high		
Carrying capacity	Very high	Low to high		
Major crops	Rice, mai, cass, cot, s/cane	Mai, sorg, cot, ses, mil, b/nut, sisal, past		
Soil moisture dependency	High	Moderate to high		
Mapping units	B3a	B2p1, B2r, B3c1-3, B3d1-2, B3h1-2		

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone		Me-5c	Me-5d	Me-5b
Drought risk		Moderate	Moderate	Low to moderate
Rainfall pattern		Trans(-bi/mono)	Trans	Trans(-mono)
Temperature regime		Warm	Warm	Warm
Growing season		3-5/6.5 and 1-2	3-4.5 or more	3-4.5 (flooding)
Land use density		Moderate	Low to high	High
Carrying capacity		Low to moderate	Moderate	Low to moderate
Major crops		Mai, cot, sorg, ses, sisal	Rice, mai, cass, sw.pot, cot,	Rice, mai, cass

			sisal	
Soil moisture dependency		Moderate to high	Moderate to high	Moderate
Mapping units		C3a1-2, C3b, C3c	B3j1-2, C3h	B3b, B3i, C3i
Average annual rainfall more than 500 mm with higher drought risk				
Agro-ecological zone		Me-7		
Drought risk		Moderate to high		
Rainfall pattern		Bi-trans		
Temperature regime		Intermediate to warm		
Growing season		2/3-4.5 (and 1-2)		
Land use density		Moderate		
Carrying capacity		Low		
Major crops		Mai, sorg, mil, leg, past, ranch		
Soil moisture dependency		Low to moderate		
Mapping units		D2a2, D3a, D3b1-2		
Soil types specific per farming system group or soil group				
Very shallow soils (Lithosols)		(111)		
Mod. well dr. Fluvisols	205			201
Well dr., mod. leached Luvi/Acri/Cambisols		334, 335	332	
Ferralsols		362, 363		
Mod. leached, well dr. Luvi/Acri/Cambisols		412, 413		
Str. leached, well dr. Paleosols and Ferralsol/Acrisols		452, 453, 461, 473, 476		
Arenosols		(501), 503	521	
Hardpan soils	611		601	
Poorly dr. Fluvisols	633, 646		(631), 632	621, 641
Mod. leached Gleysols		(688)	(677)	
Vertisols		(735, 736)	723, 724	
Acid sulphate soils				751
Solonetz-Solonchaks				761
Histosol			781	

Constraints:

- Fertility
- Low organic matter content in sandy soils
- Acidity in A and B climatic zones, but also likely in strongly leached soils in drier climatic zones
- Erosion by run-off in A climatic zones and locally in B-climatic zones
- Gully erosion and soil degradation occurring in B, C and D-climatic zones
- Soil depth
- Workability
- Drought in C, D and E climatic zones
- Salinity and sodicity constraints occurring locally in C- and D-climatic zones

- Flooding and drainage in major valleys and floodplains and locally in depressions

Description of the different agro-ecological zones

Me-1

Mwese-Mpande range

- Associated zones: Me-2a, Me-2b, Me-3, Me-4a, Me-5a, Me-6a, Me-6b
- Mapping unit: Ali
- Geology, parent material: gneiss (Ubendian)
- Climatic zones: A, monomodal, 1200-1300 mm annual rainfall; Temperature regime: 1, 1100-2500 m altitude
- Soil group: 25c; Soil types: Sandy Ferric Cambisol: 335; Arenosols: 506?; Rhodic Ferralsols: 364; Moderately leached Luvi/Acri/Cambisols: 421; Strongly leached Ferralsol/Acrisols: 473
- Farming system: Maize-Bean (2)
- Farming system group: 2b3
- Topography: very gently undulating to rolling, to hilly (2d2) ??
- Proportion of cultivated land: very low?; Carrying capacity: low
- Dependency on soil available moisture: high; Drought risk: low; Length of growing season: 6-8.5 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, acidity, erosion, capping/surface sealing

Me-2a

Lake Tanganyika and Nyasa shores, Karema depression

- Associated zones: Me-1, Me-3, Me-4a, Me-5a, Me-6a, Me-6b
- Mapping units: A2c, A2d4, A2e
- Geology, parent material: granite, gneiss, schist (Karagwe/Ankolean (1), Ubendian, Bukoba (1), Mocambique, Dodoma, Basement complex)
- Climatic zones: A, monomodal (A2c, A2d4, A2e), 1000-1500 mm annual rainfall; Temperature regime: (1-)2, 500-1300 m altitude
- Soil groups: 25b and 25c; The soil types in this zone are not yet well defined: Very shallow soils: 106?; Nitosol: 272?; Ferralsols: 364?; Strongly leached Ferralsol/Acrisols: 473; 475?
- Farming systems: Cassava-Rice and Maize-Bean (2)
- Farming system groups: 1b1, 2b3
- Topography: flat to very gently undulating
- Proportion of cultivated land: high to very high; Carrying capacity: medium to high
- Dependency on soil available moisture: high; Drought risk: low; Length of growing season: 5-7+ months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, salinity, sodicity?, flooding, erosion, acidity, soil depth (drought stress), capping/surface sealing

Me-2b

North-Sengerema, Ukerewe island, western Mara?

- Associated zones: Me-1, Me-3, Me-4a, Me-5a, Me-6a, Me-6b
- Mapping unit: A2b
- Geology, parent material: granite (Basement complex)

- Climatic zones: A, transitional-bimodal, 1000-1200 mm annual rainfall; Temperature regime: 2, 1200-1300 m altitude
- Soil group: 25e; Soil types: Very shallow Lithosols: 111; Sandy Luvi/Acri/Cambisols: 335a; Rhodic Ferralsols: 381; Moderately leached Luvi/Acri/Cambisols: 421a
- Farming systems: Maize-Cassava-Cotton-Rice
- Farming system groups: 2g1
- Topography: gently undulating
- Proportion of cultivated land: very high; Carrying capacity: low
- Dependency on soil available moisture: low to high; Drought risk: low; Length of growing season: 4-5 months
- Constraints:
 - Climatic: drought, radiation
 - Soils: fertility, soil depth (drought stress), workability, acidity, erosion, capping/surface sealing

Me-2c

Kyela plain

- Mapping unit: A3a
- Geology, parent material: lake sediments (Recent (2))
- Climatic zones: A, monomodal, 1000-2600 mm annual rainfall; Temperature regime: 3, 500 m altitude
- Soil group: 9; Soil types: Well or moderately well drained Fluvisols: 206; Poorly drained Fluvisols: 647;
- Farming system: Rice, cocoa
- Farming system group: 1c1
- Topography: flat
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture low; Drought risk: low; Length of growing season: > 8 months
- Constraints:
 - Climatic: humidity, excess rainfall
 - Soils: flooding, fertility, drainage

Me-3

Kate-Mwazye hills and Nkungwe mountain

- Associated zones: Me-1, Me-2a, Me-2b, Me-4a, Me-5a, Me-6a, Me-6b
- Mapping unit: B1c
- Geology, parent material: granite, schist (Karagwe/Ankolean (1))
- Climatic zones: B, monomodal, 850-1200 mm annual rainfall; Temperature regime: 1(-2?), 1500-2300 m altitude
- Soil group: 25a; Soil types; Very shallow Lithosols: 115; Sandy Ferric Cambisols: 339; Arenosols: 504; Moderately leached Luvi/Acri/Cambisols: 422; Strongly leached Ferralsol/Acrisols: 475
- Farming system: Maize-Finger millet (1a)
- Farming system groups: 1e1
- Topography: undulating to rolling
- Proportion of cultivated land: high; Carrying capacity: medium
- Dependency on soil available moisture: high; Drought risk: (very) low; Length of growing season: 5-9 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: soil depth (drought stress), erosion, fertility, acidity, low organic matter content, capping/surface sealing

Me-4a

Yambamrizi range and Ipumba hills, Western plateau, Inyonga and Kipembawe plains, Uriwira plain, Bukombe-Kahama plateau, Tabora plain, West Sukumaland plains

- Associated zones: Me-1, Me-2a, Me-2b, Me-3, Me-5a, Me-6a, Me-6b
- Mapping units: B2a1, B2a2, B2d1, B2d2, B2d3, B2d4, B2j1, B2j2, B2j3, B2j4, B2k
- Geology, parent material: granite, gneiss, schist (Ubendian, Dodoma, Basement complex)
- Climatic zones: B, monomodal (to transitional, B2k), 700-1200 mm annual rainfall; Temperature regime: (1-)2, 850-1800 m altitude
- Soil groups: 25a, 25c, 25d and 25e; Soil types: Very shallow Lithosols: 111; Sandy Ferric Cambisols: 335; 339; Arenosols: 501; Rhodic Ferralsols: 381 (esp. B2j2); Moderately leached Luvi/Acri/Cambisols: 421; Strongly leached Ferralsol/Acrisols: 473; 477; Well or moderately well drained Fluvisols: 210; Moderately leached Gleysols: 691; Imperfectly to poorly drained Vertisols: 735; Poorly drained Fluvisols: 651
- Farming systems: Maize-Bean (2), Maize-Fingermillet (1a,1b), Maize-Groundnut-Tobacco-(agro-)Pastoralism and Tobacco-(agro-)Pastoralism (1a)
- Farming system groups: 1e1, 2b3, 2d2, 2g1
- Topography: gently undulating to rolling, to hilly, some dissection
- Proportion of cultivated land: low to very high; Carrying capacity: low
- Dependency on soil available moisture: low to moderate?; Drought risk: low to high; Length of growing season: 4-6 months
- Constraints: fertility, flooding, erosion, acidity, soil depth (drought stress), workability, low organic matter content, soil degradation (gully erosion), capping/surface sealing

Me-4b

Mahenge basin, Mkulula valley, west Mikumi, Kilombero-Mahenge plain, Eastern lowland footslopes, Masisi plain, Nachinwea plain, Eastern plains, Muheza plains, south-east Tunduru/west Nachinwea plain

- Associated zones: Me-5c, Me-7
- Mapping units: B2p1, B2r, B3c1, B3c2, B3c3, B3d1, B3d2, B3h1, B3h2
- Geology, parent material: gneiss (Mocambique), maybe partly covered by Plio-Pleistocene (5) coastal sand
- Climatic zones: B, transitional to monomodal, 800-1000 mm annual rainfall; Temperature regime: 2-3, 150-1000 m altitude
- Soil group: 26; Soil types: Sandy Luvi/Acri/Cambisols: 335; Arenosols: 503; Ferralsols: 362+363; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 412; Strongly leached Paleosols: 453; Strongly leached Ferralsol/Acrisols: 473; 476
- Farming systems: Maize-Sorghum-(agro-)Pastoralism (1b) and Cotton-Maize (1b); : Maize-Sorghum (2a), Sorghum-Millet-Bambara groundnuts (1a), Cotton-Maize (1b), Maize-Sesame (1a) and sisal estates
- Farming system group: 2m1
- Topography: flat to rolling, locally strongly dissected
- Proportion of cultivated land: medium to very high; Carrying capacity: low to high

- Dependency on soil available moisture: moderate to high; Drought risk: low to moderate; Length of growing season: 4-9 months or 3-4.5+2.5-3 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, acidity, workability, soil depth (drought stress), soil degradation (gully erosion), low organic matter content, capping/surface sealing

Me-4c

Kilombero valley

- Mapping unit: B3a
- Geology, parent material: stream deposits
- Climatic zones: B, transitional pattern, 900-1200 mm annual rainfall; Temperature regime: 3, 400-600 m altitude
- Soil group: 12; Soil types: Well or moderately well drained Fluvisols: 205; Imperfectly drained hardpan soils: 611; Poorly drained Fluvisols: 633;
- Farming system: Rice-Maize-Cassava-Cotton, sugarcane estate
- Farming system group: 1g2
- Topography: flat, floodplain
- Proportion of cultivated land: high; Carrying capacity: very high
- Dependency on soil available moisture: high; Drought risk: moderate; Length of growing season: 5.5-8 months, depending on flooding
- Constraints: flooding, fertility, acidity, low organic matter content?

Me-5a

Dissected Chunya plain, Tunduma-Ndalambo stretch, Lyambalomfipa escarpment

- Associated zones: Me-1, Me-2a, Me-2b, Me-3, Me-4a, Me-6a, Me-6b
- Mapping units: C2a1, C2a2
- Geology, parent material: gneiss (Ubendian)
- Climatic zones: C, monomodal, 700-1300 mm annual rainfall; Temperature regime: 1-2, 1000-1800 m altitude
- Soil groups: 25d and 25e; Soil types: Very shallow Lithosols: 111; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 421
- Farming systems: Maize-Fingermillet (1b) and Tobacco-(agro-)Pastoralism (1a)
- Farming system groups: 2d2, 2g1
- Topography: undulating to rolling, dissected
- Proportion of cultivated land: low; Carrying capacity: medium
- Dependency on soil available moisture: moderate to high; Drought risk: low; Length of growing season: 4-7 months
- Constraints:
 - Climatic: drought
 - Soils: flooding, fertility, acidity, soil depth (drought stress), low organic matter content, capping/surface sealing, soil degradation (gully erosion)

Me-5b

Rufiji valley, coastal floodplains and deltas

- Mapping units: B3b, B3i, C3i
- Geology, parent material: stream deposits (Recent (1))

- Climatic zones: B-C, transitional to monomodal, 800-1200 mm annual rainfall; Temperature regime: 3, < 200 altitude
- Soil group: 28; Soil types: Well or moderately well drained Fluvisols: 201; Acid sulphate soils: 751; Poorly drained Fluvisols: 621; 641; Salty and/or sodic soils: 761
- Farming system: Rice-Maize-Cassava-Cotton (?)
- Farming system group: 1h3
- Topography: flat
- Proportion of cultivated land: high; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: low to moderate; Length of growing season: ,3-4.5 months (+flooding)
- Constraints:
 - Climatic: drought
 - Soils: flooding, acidity?, low organic matter content, salinity?

Me-5c

Eastern and Southern plains

- Associated zones: Me-4b, Me-7
- Mapping units: C3a1, C3a2, C3b, C3c
- Geology, parent material: gneiss (Mocambique), maybe partly covered by Plio-Pleistocene (5) coastal sand
- Climatic zones: C, transitional (and possible extension towards bi- and monomodal patterns), 500-1000 mm annual rainfall; Temperature regime: (2-)3, 200-1000 m altitude
- Soil group: 26; Soil types: Sandy Luvi/Acri/Cambisols: 334; Arenosols: 503; Ferralsols: 362+363; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 412+413; Strongly leached Paleosols: 452+453; Strongly leached Ferralsol/Acrisols: 473; 476
- Farming systems: Cotton-Maize (1b), Maize-Sorghum (2a), Maize-Sesame (1a) and sisal estates
- Farming system group: 2ml
- Topography: flat to gently undulating to rolling
- Proportion of cultivated land: medium; Carrying capacity: low to medium
- Dependency on soil available moisture: moderate to high; Drought risk: (low to) medium; Length of growing season: 3-5/6.5 or 3-4+1-2 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, acidity, soil depth (drought stress), workability, soil degradation (gully erosion), low organic matter content, capping/surface sealing

Me-5d

Eastern alluvial plains

- Mapping units: B3j1, B3j2, C3h
- Geology, parent material: stream deposits (Sub-recent (1))
- Climatic zones: B-C, transitional, 800-1000 mm annual rainfall; Temperature regime: 3, < 500 m altitude
- Soil group: 23; Soil types: Moderately leached sandy Luvi/Acri/Cambisols: 332; Arenosols: 521; Imperfectly drained hardpan soils: 601; Imperfectly to poorly drained Vertisols: 723; 724; Poorly drained Fluvisols: 632; Histosols: 781
- Farming systems: Rice-Maize-Sweet potato and Rice-Maize-Cassava-Cotton and sisal estates

- Farming system group: 1h1
- Topography: flat
- Proportion of cultivated land: low to high; Carrying capacity: medium
- Dependency on soil available moisture: moderate to high; Drought risk: moderate; Length of growing season: <3-4.5 months and possibly longer
- Constraints:
 - Climatic: drought
 - Soils: fertility, flooding, acidity, low organic matter content

Me-6a

Namanyere-Laela plain

- Associated zones: Me-1, Me-2b, Me-3, Me-4a, Me-5a, Me-6b
- Mapping unit: Dla
- Geology, parent material: gneiss (Ubendian)
- Climatic zones: D, monomodal, 750-950 mm annual rainfall; Temperature regime: 1, 1200-1700 m altitude
- Soil group: 25d; Soil types: Sandy Ferric Cambisols: 335; Arenosols: 501; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 421; Strongly leached Ferralsol/Acrisols: 477; Well or moderately well drained Fluvisols: 210; Poorly drained Fluvisols: 651
- Farming system: Maize-Fingermillet (2)
- Farming system groups: 2d2
- Topography: gently undulating
- Proportion of cultivated land: high; Carrying capacity: medium
- Dependency on soil available moisture: high; Drought risk: low to moderate; Length of growing season: 5-6.5 months
- Constraints:
 - Climatic: temperature
 - Soils: fertility, acidity, flooding, salinity, soil degradation (gully erosion), capping/surface sealing

Me-6b

Meatu-Maswa-Shinyanga area, Central-Northern plains, Chunya plains, Wago hills, Northern Iringa shallow soil hill range, Mpwapwa-East Kondoa plains

- Associated zones: Me-1, Me-2a, Me-2b, Me-3, Me-4a, Me-5a, Me-6a
- Mapping units: D2b1, D2b2, D2c, D2f, D2n, D2q1, D2q2, D2q3, D2q4
- Geology, parent material: granite, gneiss (Ubendian, Mocambique, Dodoma, Basement complex)
- Climatic zones: D, monomodal to transitional (D2f), 550-900 mm annual rainfall; Temperature regime: 2, 1000-1500 m altitude
- Soil group: 25e; Soil types: Very shallow Lithosols: 111; Shallow Phaeozems: 131; Sandy Ferric Cambisols: 335; Rhodic Ferralsols: 381; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 421; Strongly leached Paleosols: 461; Strongly leached Ferralsol/Acrisols: 473; Imperfectly to poorly drained Vertisols: 735
- Farming systems: Maize-Sorghum-Pastoralism (3), Cotton-Sorghum-Pastoralism and Maize-Groundnut-Livestock
- Farming system group: 2g1
- Topography: gently undulating
- Proportion of cultivated land: low, possibly higher in some locations; Carrying capacity: low to very low

- Dependency on soil available moisture: generally low, however variable ; Drought risk: low to moderate; Length of growing season: 2-3.5/5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, workability, flooding, salinity, sodicity, soil degradation (gully erosion), soil depth (drought stress), acidity, capping/surface sealing

Me-7

Usambara footslopes, semi-arid eastern plains

- Associated zones: Me-4b, Me-5c
- Mapping units: D2a2, D3a, D3b1, D3b2; Geology, parent material: gneiss (Mocambique)
- Climatic zones: D, bimodal to transitional, 500-1000 mm annual rainfall; Temperature regime: 2-3, 200-1200 m altitude
- Soil group: 26; Soil types: Sandy Luvi/Acri/Cambisols: 334; Ferralsol: 362; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 412+413; Strongly leached Ferralsol/Acrisols: 461; 476
- Farming systems: Maize-Sorghum-Pastoralism (4), Sorghum-Millet-(non bean)legumes-(1b), ranches and Maize-Bean (5b)
- Farming system group: 2m1
- Topography: flat to undulating to rolling
- Proportion of cultivated land: medium; Carrying capacity: low
- Dependency on soil available moisture: low to moderate; Drought risk: low to very high; Length of growing season: 2-4/4.5 or 3-4/4.5+1-2
- Constraints:
 - Climatic: drought
 - Soils: fertility, flooding, acidity, drainage, soil degradation (gully erosion), capping/surface sealing

SANDSTONE (Sa)

Agro-ecological zones Sa-1, Sa-2a,2b, Sa-3a,3b, Sa-4 and Sa5.

Area covered by **Karoo sandstone and shale and Jurassic-Paleogene sandstone, shale and limestone**, as well as the hydromorphic Kilimbero valley

General description:

- Climatic range A-D, monomodal (south-west) to bimodal (northern coast)
- Temperature range: 2-3, intermediate to warm
- Growing season range: 3-9 months
- Drought risk: very variable, depending on actual zone
- Soil groups: 14, 15
- Farming system groups: 1g1, 2i1, 2n1
- Land use density: low to moderate in upland areas, moderate to very high in hydromorphic areas
- Carrying capacity: generally low
- Major cash crops: cashew, coconut, sesame
- Major food crops: maize, cassava, sorghum, bean

Sub-division:

- Sa-I, SZ, EZ, SH (Ruvuma)
- Sa-II, coastal hinterland

	SE-Songea plain, (Dissected) sedimentary plain in Eastern and Southern, NE-Songea/Tunduru, Selous, Gumbiro, Ruhuhu valley, Southern plains	Southern and Eastern hinterland plains and hills, makonde plateau
Physiographic unit	EA4a,b, SD, SU	CD2-3, CH2
CMU	B3(d), F2d	A5(d)
Farming system group	2i1	1g1, 2n1
Soil group	14	15
Geology	Sandstone, shale	Sandstone, shale, limestone
	Karoo, Plio-Pleistocene 4	Jurassic-Paleogene
Annual rainfall	500-1200	800-1000
Altitude (m)	200-1100	< 500
Climatic/temperature range	A2-B3-C2,3-D2,3	B3-C3
Crops	Cash-mai-ses-bean-past	Cash-mai-sorg

Average annual rainfall more than 1000 mm and up to 1000/2600 mm, intermediate to warm conditions

Agro-ecological zone	Sa-1	
Drought risk	Low	
Rainfall pattern	Mono	
Temperature regime	Intermediate to warm	
Growing season	5-7	
Land use density	Moderate	
Carrying capacity	High	
Major crops	Cash, mai	
Soil moisture dependency	High	
Mapping units	A2f, A2g	

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone	Sa-2a	Sa-2b
Drought risk	Moderate	Moderate

Rainfall pattern	Trans	Trans
Temperature regime	Intermediate to warm	Warm
Growing season	4-7	3-4.5 and 1-2
Land use density	Low	Moderate to very high
Carrying capacity	Low	Low
Major crops	Cashew	C/nut, cass, cash
Soil moisture dependency	High	Moderate
Mapping units	B3f	B3g1-3

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone	Sa-3a	Sa-3b
Drought risk	Low	High to very high
Rainfall pattern	Mono(-trans)	Bi
Temperature regime	Intermediate to warm	Warm
Growing season	< 5-7/9	< 3-4.5 and 1-2
Land use density	Low to moderate	Moderate
Carrying capacity	Low	Low
Major crops	Cash, mai, ses, bean	C/nut, cass, cash, mai, sorg, sisal
Soil moisture dependency	Moderate to high	Moderate
Mapping units	C2d1-2, C2f, C3g	C3d

Average annual rainfall more than 500 mm but variable, relatively low drought risk

Agro-ecological zone	Sa-4	
Annual rainfall	600-1000	
Rainfall pattern	Mono	
Temperature regime	Intermediate to warm	
Growing season	5-6	
Land use density	Moderate	
Carrying capacity	Low	
Major crops	Mai, bean	
Soil moisture dependency	High	
Mapping units	D2i	

Average annual rainfall more than 500 mm with higher drought risk

Agro-ecological zone	Sa-5	
Drought risk	moderate	
Rainfall pattern	Bi-trans	
Temperature regime	Warm	
Growing season	3-4.5	
Land use density	Very low	
Carrying capacity	Low	
Major crops/land use	Past (Park)	
Soil moisture dependency	Moderate	
Mapping units	D3c	

Soil types specific per farming system group or soil group

Very shallow soils (Lithosols)	110	107-112
Phaeozem/Cambisols		236
Ferralic Cambisols	340, 342	
Arenosols	526, 527	
Mod. well dr. Vertisols		541
Poorly dr. Fluvisols	(650)	674
Mod. leached Gleysols	(692, 693)	
Poorly dr. Vertisols	725	722

Constraints:

- Soil depth, very shallow soils
- Fertility, low organic matter contents in light textured soils
- Acidity: likely in light textured soils with higher rainfall
- Compaction in moderately well drained Vertisols
- Drought (light textured soils in higher drought risk areas)

- Erosion, partly natural erosion, but probably also accelerated erosion when run-off is allowed to occur locally. Mainly in A- and B-climatic zones
- Workability constraints in Vertisols
- Flooding and drainage in poorly drained soils
- Some salinity problems in hydromorphic areas in drier zones

Description of the different agro-ecological zones

Sa-1

SE-Songea plain

- Associated zones: Sa-2a, Sa-3a, Sa-4, Sa-5
- Mapping units: A2f, A2g
- Geology, parent material: sandstone and shale
- Climatic zones: A, monomodal, 1000 mm annual rainfall; Temperature regime: 2-3, 500-800 m altitude
- Soil group: 14; Soil types: Very shallow Lithosols: 110; Sandy Ferric Cambisols: 342
- Farming systems: Cashew (1)[Maize-Forestry (1a) in shallow soil areas]
- Farming system group: 2i1
- Topography: hilly, steeply dissected
- Proportion of cultivated land: medium; Carrying capacity: high
- Dependency on soil available moisture: high; Drought risk: low; Length of growing season: 5-7 months
- Constraints: fertility, soil depth (drought stress), low organic matter?, erosion

Sa-2a

Sedimentary plateau in Eastern and NE Songea/N-Tunduru

- Associated zones: Sa-1, Sa-3a, Sa-4, Sa5
- Mapping unit: B3f
- Geology, parent material: sandstone and shale
- Climatic zones: B, transitional, 600-1000 mm annual rainfall; Temperature regime: 2-3, 600-1100 m altitude
- Soil group: 14; Soil types: Sandy Ferric Cambisols: 340+342;
- Farming systems: Cashew (1 and 2)
- Farming system group: 2i1
- Topography: rolling to hilly, steeply dissected
- Proportion of cultivated land: low; Carrying capacity: low
- Dependency on soil available moisture: high; Drought risk: low to moderate; Length of growing season: 4-7 months
- Constraints:
- Climatic: drought
- Soils: fertility, low organic matter?, erosion

Sa-2b

Southern and Eastern hinterland plains and hills, Makonde plateau

- Associated zone: Sa-3b
- Mapping units: B3g1, B3g2, B3g3
- Geology, parent material: sandstone, limestone, shale (Jurassic-Paleogene)
- Climatic zones: B, transitional, 800-1000 mm annual rainfall; Temperature regime: 3, 100-500 m altitude

- Soil groups: 15a and 15b; Soil types: Very shallow Lithosols: 107+112; Phaeozems/Cambisols: 236; Moderately well drained Vertisols: 541; Moderately leached Gleysols: 674; Imperfectly to poorly drained Vertisols: 722
- Farming systems: Coconut-Cassava-Cashew or Cashew (1)
- Farming system group: 1g1, 2n1
- Topography: undulating to rolling, some dissection
- Proportion of cultivated land: medium to very high; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: low to high; Length of growing season: 3-4.5 months and short season (B3g3) 1-2 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, salinity, workability, compaction, erosion, low organic matter, soil depth (drought stress)

Sa-3a

Ruhuha valley, (dissected) sedimentary plateau in Southern zone

- Associated zones: Sa-1, Sa-2, Sa-4, Sa-5
- Mapping units: C2d1, C2d2, C2f, C3g
- Geology, parent material: sandstone and shale
- Climatic zones: C, monomodal to transitional, 600-1200 mm annual rainfall; Temperature regime: 2-3, 200-1000 m altitude
- Soil group: 14; Soil types: Sandy Ferric Cambisols: 340+342; Arenosols: 527
- Farming systems: Maize-Sesame (1b), Maize-Bean (4b) and Cashew (1,2)
- Farming system group: 2i1
- Topography: undulating to rolling, some dissection, locally steeply dissected
- Proportion of cultivated land: low to medium; Carrying capacity: low
- Dependency on soil available moisture: moderate to high; Drought risk: low to moderate; Length of growing season: <5-9 months
- Constraints:
 - Climatic: drought, radiation?
 - Soils: fertility, erosion, acidity?, low organic matter content

Sa-3b

Eastern hinterland plains and hills

- Associated zone: Sa-2b
- Mapping unit: C3d
- Geology, parent material: sandstone, limestone, shale (Jurassic-Paleogene)
- Climatic zones: C, bimodal, 800 mm annual rainfall; Temperature regime: 3, < 200 altitude
- Soil group: 15b; Soil types: Moderately well drained Vertisols: 541; Moderately leached Gleysols: 674
- Farming systems: Coconut-Cassava-Cashew or Maize-Sorghum (2a) and sisal estates
- Farming system group: 2n1
- Topography: undulating to rolling, some dissection
- Proportion of cultivated land: medium; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: moderate to high; Length of growing season: <3-4.5 and 1-2 months

- Constraints:
 - Climatic: drought
 - Soils: fertility, workability, compaction, low organic matter content

Sa-4

Gumbiro area

- Associated zones: Sa-1, Sa-2a, Sa-3a, Sa-5
- Mapping unit: D2i
- Geology, parent material: sandstone and shale
- Climatic zones: D, monomodal, 600-1000 mm annual rainfall; Temperature regime: 2-3, 800-1200 m altitude
- Soil group: 14; Soil types: Sandy Ferric Cambisols: 342; Arenosols: 527; Imperfectly to poorly drained Vertisols: 725
- Farming system: Maize-Bean (4b)
- Farming system group: 2i1
- Topography: strongly dissected, rolling to hilly
- Proportion of cultivated land: medium; Carrying capacity: low
- Dependency on soil available moisture: high; Drought risk: low; Length of growing season: 5-6 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, drainage, low organic matter content

Sa-5

Southern plains

- Associated zones: Sa-1, Sa-2a, Sa-3a, Sa-4
- Mapping unit: D3c
- Geology, parent material: sandstone and shale
- Climatic zones: D, transitional, 500-800 mm annual rainfall; Temperature regime: (2-)3, 200-500 m altitude
- Soil group: 14; Soil types: Sandy Ferric Cambisols: 340
- Farming system/land use system: Park (1c)
- Farming system group: 2i1
- Topography: gently undulating to rolling
- Proportion of cultivated land: very low; Carrying capacity: low
- Dependency on soil available moisture: moderate; Drought risk: low to moderate; Length of growing season: 3-4.5 months
- Constraints:
 - Climatic: drought
 - Soils: fertility, low organic matter content

VARIOUS SEDIMENTS (Se)

Agro-ecological zones Se-1, Se-2, Se-3a,3b.

Area covered by **lacustrine, alluvial and wash sediments**

General description:

- Climatic range: B-E, monomodal (south) to transitional (north)
- Temperature range: 2, intermediate temperatures
- Growing season range: 3-3.5 months or shorter
- Drought risk: low to moderate (although drought is a major constraint)
- Soil groups: 21, 22
- Farming system groups: 1k1, 1k2, 211
- Land use density: low to moderate, probably higher in southern Lake zone
- Carrying capacity: low to very low
- Major cash crops: cotton, rice, livestock
- Major food crops: rice, sorghum, maize, millet, sunflower, groundnut, cassava
- Occurring in LZ, CZ, SH, NZ, WZ

Sub-division

	Mbuga areas (Sukumaland), Central irrigated/flooded area, Shinyanga-Igunga area, dry Kwimbe-Shinyanga area	Ruaha lowland/valley, NW+SW Lake Eyasi, W-Mbulu, N-Irambu, Lake Manjara shore, S-Dodoma
Physiographic units	PPp2, Pps1-2, PSa,b	NR1, PH1, Ppp2, PPw1, RA2, RP2
CMU	H2	C6(h), G2, G8, H2
Farming system group	211	1k1, 1k2
Soil group	22	21
Geology	Lake, stream deposits	Lake, stream and wash deposits
	Sub-recent 2	Plio-Pleistocene 6, Dodoma granite and gneiss, Sub-recent 2, Recent 2
Annual rainfall	400-1000	400-600?
Altitude (m)	1000-1200	1100-1300?
Climate/temp. range	B2-D2-E2	E2
Crops	Mai-cass-cot-rice-sorg-past	Mai-rice-sorg-sunf-past

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone	Se-1	
Drought risk	Low	
Rainfall pattern	Trans	
Temperature regime	Intermediate	
Growing season	3-3.5	
Land use density	High?	
Carrying capacity	Very low ??	
Major crops	Mai, cass, cot, rice	
Soil moisture dependency	Low to moderate	
Mapping units	B2m	

Average annual rainfall more than 500 mm but variable, relatively low drought risk

Agro-ecological zone	Se-2	
Annual rainfall	500-800	
Rainfall pattern	Mono(-trans)	

Temperature regime	Intermediate	
Growing season	3-3.5	
Land use density	High	
Carrying capacity	Very low	
Major crops	Cot, sorg, rice, mil, past	
Soil moisture dependency	Low	
Mapping units	D2p1, D2s	

Average annual rainfall more than 400 and up to 600/800 mm, semi-arid to arid and intermediate temperature conditions

Agro-ecological zone	Se-3a	Se-3b
Drought risk	Low	Low to moderate
Rainfall pattern	Trans	Mono-trans
Growing season	nd (3-5?)	3-3.5?
Land use density	nd	Low to moderate
Carrying capacity	nd	Low to very low
Major crops	Rice, past	Mai, sorg, sunf, rice, gr/nut, past
Soil moisture dependency	nd	Low to moderate
Mapping units	Ea1	Ea2, Eb3, Eb4, Ec1, Ed2, Eg1

Soil types specific per farming system group or soil group

Very shallow soils		111
Shallow soils		(131)
Phaeozem/Cambisols	239	
Well dr. sandy soils		335, 343-4
Mod. leached, well dr. soils		421, 425
Str. leached, well dr. soils		455
Arenosols		(501), 507, (509)
Hardpan soils	604	(604), 605
Mod. leached Gleysols		679, (689, 691)
Vertisols	(727), 738 , (739)	(734), 735, 738
Solonetz-Solonchak		766, 772

Constraints:

- Workability in heavy textured soils (Vertisols)
- Drought in all areas
- Salinity and sodicity in drier areas (D and E climatic zones)
- Erosion and soil degradation in D and E climatic zones
- Soil depth
- Fertility in light textured soils
- Flooding and drainage problems in flat alluvial areas

Description of the different agro-ecological zones

Se-1

Mbuga areas (Sukumaland)

- Associated zones: Se-2, Se-3a
- Mapping unit: B2m
- Geology, parent material: stream and lake deposits (Sub-recent (2))
- Climatic zones: B, transitional, 800-1000 mm annual rainfall; Temperature regime: 2, 1000-1200 m altitude
- Soil group: 22b; Soil types: Imperfectly to poorly drained Vertisols: 738
- Farming system: Maize-Cassava-Cotton-Rice
- Farming system group: 211

- Topography: flat; Proportion of cultivated land: high ??; Carrying capacity: very low??
- Dependency on soil available moisture: low to moderate; Drought risk: low to moderate; Length of growing season: 3-3.5 months
- Constraints:
 - Climatic: drought
 - Soils: workability, flooding, low organic matter content?

Se-2

Central irrigated/flooded area, Shinyanga-Igunga

- Associated zones: Se-1, Se-3a
- Mapping units: D2p1, D2s
- Geology, parent material: stream and lake deposits (Sub-recent (2))
- Climatic zones: D, monomodal (to transitional), 500-800 mm annual rainfall; Temperature regime: 2, 900 m altitude
- Soil groups: 22a and 22b; Soil types: Phaeozems/Cambisols: 239; Imperfectly drained hardpan soils: 604; Salty and/or sodic soils: 764
- Farming systems: Cotton-Sorghum-Pastoralism and Rice-Sorghum-Millet
- Farming system group: 1j2, 2l1
- Topography: flat
- Proportion of cultivated land: high; Carrying capacity: very low
- Dependency on soil available moisture: low; Drought risk: low to high; Length of growing season: 3-3.5 months (variable)
- Constraints:
 - Climatic: drought
 - Soils: fertility, workability, flooding, salinity, sodicity, soil degradation (gully erosion)

Se-3a

S-Kwimbe/N-Shinyanga area

- Associated zones: Se-1, Se-2
- Mapping unit: Eal
- Geology, parent material: stream and lake deposits (Sub-recent (2))
- Climatic zones: E, transitional, 400-800 mm annual rainfall; Temperature regime: 2, 1000-1200 m altitude
- Soil group: 22b; Soil types: Imperfectly to poorly drained Vertisols: 738;
- Farming system: Rice-Pastoralism (2)
- Farming system group: 2l1
- Topography: flat
- Proportion of cultivated land: nd; Carrying capacity: nd
- Dependency on soil available moisture: nd; Drought risk: low to moderate
- Constraints:
 - Climatic: drought
 - Soils: workability, fertility, flooding, drainage, salinity, sodicity, soil degradation (gully erosion)

Se-3b

Ruaha lowland/valley, NW and SW Eyasi, southern Dodoma, western Iringa, western Mbulu, northern Irambu, lake Manjara shore

- Mapping units: Ea2, Eb3, Eb4, Ec1, Ed2, Egl
- Geology, parent material: granite, gneiss and lake, stream and/or wash deposits
- Climatic zones: E, monomodal to transitional, 400-800 mm annual rainfall; Temperature regime: 2, 700-1300 m altitude
- Soil groups: 21a and 21b; Soil types: Very shallow Lithosols: 111; Sandy Ferric Cambisols: 335; 343?+344; Arenosols: 507; Moderately leached loamy or clayey Luvi/Acri/Cambisols: 421; 425?; Strongly leached Paleosols: 455; Moderately leached Gleysols: 679; Imperfectly to poorly drained Vertisols: 735; 738; Salty and/or sodic soils: 766; 772 [This zone can also be placed in the Gneiss, granite, schist group]
- Farming systems: Maize-Sorghum-Sunflower-Pastoralism, Rice-Pastoralism (1), Maize-groundnut-Livestock or Pastoralism (2a)
- Farming system group: 1k1, 1k2
- Topography: gently undulating
- Proportion of cultivated land: low; Carrying capacity: low to very low
- Dependency on soil available moisture: low to moderate; Drought risk: low to moderate; Length of growing season: 3-3.5 months ?(unsure)
- Constraints:
 - Climatic; drought
 - Soils: fertility, soil depth (drought stress), soil degradation (gully erosion, salinity, sodicity, flooding, capping/surface sealing)

VOLCANIC ASH (Vo)

Agro-ecological zones Vo-1a,1b,1c, Vo-2, Vo-3, Vo-4a,4b,4c, Vo-5a,5b,5c and Vo-6.

Area covered by **volcanic ash**, sometimes with basalt, sometimes underlain by gneiss, including Pangani valley originating from the Kilimanjaro area.

General description:

- Climatic range: A-E, monomodal (Southern highlands) to bimodal-transitional (Northern zone)
- Temperature range: 1-2, cool to intermediate
- Growing season range: very variable, related to average annual rainfall
- Drought risk: very variable. Low risks with average annual rainfall of more than 800 mm or at higher altitudes (> 1200 m). Moderate drought risks for areas with average annual rainfall between 600 and 800 mm. Moderate to very high drought risks in areas with average annual rainfall less than 600 mm.
- Soil groups: 1, 2, 4, 6, 16
- Farming system groups: 1a1, 1d2, 1i1, 1j1, 2a2, 2c1, 2k1
- Land use density: usually high to very high, where agriculture is possible
- Carrying capacity: strongly related to rainfall. High in high rainfall areas, but low in dry areas.
- Major cash crops: coffee, banana, horticulture, bean, wheat
- Major food crops: maize, bean, potato, cassava, sorghum, pigeon pea, sunflower, rice, sweet potato

Sub-division:

- Vo-I, SH
- Vo-II, NZ

		Rungwe/Mbeya highlands, (west) Njombe plateau, Mbeya stepped plain	Rungwe/Mbeya highlands, (west) Njombe plateau	Meru/Kilimanjaro footslopes and plains, Karatu plateau, Northern lowlands, Hanang, Babati
Physiographic units		HP4, HU2, HV1-2	HP1, 3-4	NA6-7, 9, NC2, NP3, NV3a,b
CMU		E3(h)	D6v, D5v, E1(h)	E2(h), E4(h), H2v, H4v
Farming system group		2a2	1a1	2c1
Soil group		1b	1a	4a
Geology		Basalt, volcanic ash	Volcanic ash	Volcanic ash
		Pleistocene 4v	Plio-Pleistocene 7v	Sub-recent 3v (Meru), Plio-Pleistocene 8v (Kilimanjaro)
Annual rainfall		600-2000	1000-1600	500-2000
Altitude (m)		600-2600	1600-2900	500-2500
Climate/temp. range		A1-B2	A1	A1-B1,2-D2
Crops		Mai-pot-coff-ban-bean	Mai-pot	Coff-ban-mai-bean-pot-wheat-ppea-past

Average annual rainfall more than 1000 mm and up to 1300 to 2000 mm or more, monomodal pattern, low drought risk, intermediate to cool or very cool conditions

Agro-ecological zone		Vo-1a (high	Vo-1a(high	Vo-1c
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		alt.)/1b (lower alt.)	alt.)/1b (lower alt.)	
Temperature regime		(Very) cool	(Very) cool	Intermediate to cool
Growing season		> 6-8+	> 6-8+	> 5-7+
Land use density		Very high	Very high	Very high
Carrying capacity		High	High	Very high
Major crops		Mai, pot/coff, ban	Mai, pot/coff, ban	Coff, ban
Soil moisture dependency		Low	High	Low
Mapping units		A1h1-2, (Alb, Alc)	A1a1-2, A1g1-2	A1k1-2

Average annual rainfall more than 700 mm and up to 900-1300 mm with variable drought risk

Agro-ecological zone				Vo-3
Drought risk				Moderate
Rainfall pattern				Trans-bi
Temperature regime				Intermediate to cool
Growing season				3-5/6
Land use density				Moderate to very high
Carrying capacity				Low to high
Major crops				Mai, bean, pot (coff, ban)
Soil moisture dependency				Moderate to high
Mapping units				B1a1-2, B2b1-2

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone		Vo-4a		
Drought risk		Low		
Rainfall pattern		Mono		
Temperature regime		Cool		
Growing season		6-9		
Land use density		Very high		
Carrying capacity		High		
Major crops		Mai, bean		
Soil moisture dependency		High		
Mapping units		C1c		

Average annual rainfall more than 500 mm with higher drought risk

Agro-ecological zone				Vo-5b
Drought risk				Moderate to very high
Rainfall pattern				Trans
Temperature regime				Intermediate to cool
Growing season				2-3.5 (3-5?)
Land use density				Moderate to very high (?)
Carrying capacity				Low
Major crops				Mai, bean, wheat, ppea, past
Soil moisture dependency				Low to high
Mapping units				D2h2, D2k1-3, D2l

Soil types specific per farming system group or soil group

Very shallow Phaeozem/Vitric Andosols		(103, 111)	(105, 111)	101-2, (111)
Shallow Humic and Vitric Andosols		133, 145	133, 145	(132), 141

Luvic Phaeozems				231
Humic/Mollic and Vitric Andosols		261, 265	261b, 265	262
Humic Nitisols		(272), 275	(272, 275), 273	271
Sandy Eutric Nitosol				321
Ferralsols		3643	(364)	(363?)
Ferric Acrisols			473	
Arenosols			(501)	(501)
Mod. well dr. Vertisols				(543)
Poorly dr. Vertisols				734
Solonetz-Solonchak				(763)
Histosol				(782)

Second sub-division

	Mbozi plateau	Tarime highlands	Serengeti, Northern steppes	Pangani river valley
Physiographic units	HP5	NP4	NA1-8, NR3, NV1, 3b,3c	EA3a
CMU	D6v	E6	C6v, D5v, E1(h), E4(h), E5, (H2)	H2
Farming system group	1d2	1i1	2k1	1j1
Soil group	2	6	4b	16
Geology	Gneiss, volcanic ash	Volcanic phonolites	Volcanic ash	Stream deposits
	Plio-Pleistocene 8v over Ubendian gneiss	Miocene	Recent 2, Sub-recent 3v, Pliocene, Plio-Pleistocene 7v and 8v	Sub-recent 1
Annual rainfall	800-1200	800-1200	400-1000	500-600
Altitude (m)	1200-1800	1500-1800	1000	nd
Climate/temp. range	B1	C1	C2-D1,2-E2	D2
Crops	Coff-mai-bean	Mai-cass-sorg-ban-bean	Past (+Park)	Rice-mai-sw.pot

Average annual rainfall more than 800 mm and up to 1200/1400 mm, monomodal pattern, low drought risk

Agro-ecological zone	Vo-2			
Temperature regime	Cool			
Growing season	6-9			
Land use density	Very high			
Carrying capacity	High			
Major crops	Coff, mai, bean			
Soil moisture dependency	High			
Mapping units	B1d			

Average annual rainfall variable, more than 600 mm and variable drought risk

Agro-ecological zone		Vo-4b	Vo-4c	
Drought risk		Moderate	Moderate	
Rainfall pattern		Bi	Bi	
Temperature regime		Cool	Intermediate	
Growing season		6-10	nd	
Land use density		Very high	Very low	
Carrying capacity		High	Variable	

Major crops		Mai, cass, sorg, ban, hort	Past	
Soil moisture dependency		Low	nd	
Mapping units		C1a	C2e	

Average annual rainfall more than 500 mm with higher drought risk

Agro-ecological zone			Vo-5a/5b	Vo-5c
Drought risk			Moderate to very high	Moderate to very high
Rainfall pattern			Bi	Bi
Temperature regime			Cool	Intermediate to warm
Growing season			nd	< 2, flooding
Land use density			Very low	Very low
Carrying capacity			Variable	Very low
Major crops			Past, (park)	Rice, mai, sw. pot
Soil moisture dependency			nd	Low
Mapping units			D1e, D2h1,3	D2p2

Average annual rainfall more than 400 mm and up to 600/800 mm, semi-arid to arid and intermediate temperature conditions

Agro-ecological zone			Vo-6	
Drought risk			High	
Rainfall pattern			Bi-trans	
Growing season			nd	
Land use density			Very low	
Carrying capacity			Low	
Major crops			Past, park	
Soil moisture dependency			nd	
Mapping units			Ef1-5	

Soil types specific per farming system group or soil group

Very shallow Phaeozem/Vitric Andosols		(104)	(101, 105), 102	
Shallow Vitric Andosols			141-3	
Mod. well.dr. Fluvisols		(209)		
Luvic Phaeozems			231, 233-5	
Mollic Solonetz			251-2	
Vitric Andosol	264		261a, 262-3	
Humic Nitisol	(275)	273	271	
Volcanic sand dunes Ferralsol		361	(311)	
Mod. leached Luvi/Acri/Cambisols		411		
Str. leached well dr. Paleosol				(461)
Mod. well dr. Vertisols			(544)	
Poorly dr. Fluvisols		(648)		
Poorly dr. Vertisols			732-4	724
Solonetz-Solonchak			772	762
Histosol			782	

Constraints:

- Radiation and temperature at higher elevations
- Erosion and land slide hazard in A climatic zones; wind erosion on Vitric Andosols (B-climatic zones and drier areas)
- Leaching in A climatic zones, probably not severe

- Fertility (acidity problem unclear)
- Sodicity and salinity in D and E climatic zones
- Drought in B to E climatic zones, especially in D climatic zones
- Soil depth
- Soil degradation and gully erosion occurring to some extent in D-E climatic zones
- Workability in heavy textured, sometimes sodic soils

Descriptions of the different agro-ecological zones

Vo-1a (high altitude)

Volcanic Southern highlands (Mbeya, Rungwe), (west) Njombe plateau

- Associated zone: Vo-4a
- Mapping units: Ala1, Ala2, Alg1, Alg2, Alb, Alc, Alh1, Alh2
- Geology, parent material: Plio-Pleistocene (7v) or Pleistocene (4v) volcanic ash and basalt
- Climatic zones: A, monomodal, 1000-2600 mm; Temperature regime: 1, 1600-2300 m altitude
- Soil groups: 1a and 1b; Soil types: Shallow Humic Andosols: 133, 145?; Humic/Mollic Andosols: 261b, 265; Humic Nitisols: 275; Ferralsols: 364; Ferric Acrisols: 473
- Farming system: Maize-Potato (1a)
- Farming system group: 1a1, 2a2
- Topography: undulating to rolling, some dissection
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: low to high; Drought risk: low; Length of growing season: 6-12 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, erosion, landslides?, soil depth (drought stress?), capping/surface sealing

Vo-1b (lower altitudes)

Volcanic Southern highlands (Mbeya, Rungwe), (west) Njombe plateau

- Associated zones: Vo-4a
- Mapping units: Ala1, Ala2, Alg1, Alg2, Alh1, Alh2, Alb?, Alc?
- Geology, parent material: Pleistocene (4v) or Plio-Pleistocene (7v) volcanic ash and basalt
- Climatic zones: A, monomodal, 1000-2600 mm annual rainfall; Temperature regime: 1, 600-1600 m altitude
- Soil groups: 1a, 1b; Soil types: Shallow Humic Andosols: 133, 145?; Humic/Mollic Andosols: 261b, 265; Humic Nitisols: 275; Ferralsols: 364; Ferric Acrisols: 473
- Farming system: Coffee-Banana (1)
- Farming system group: 1a1, 2a2
- Topography: undulating to rolling, some dissection
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: low to high; Drought risk: low; Length of growing season: 6-12 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, erosion, landslides?, soil depth (drought stress?), capping/surface sealing

Vo-1cMeru, Kilimanjaro footslopes

- Associated zones: Vo-3, Vo-4c, Vo-5a, Vo-5b, Vo-6
- Mapping units: Alk1, Alk2
- Geology, parent material: volcanic ash (Sub-recent (3v), Plio-Pleistocene 8v)
- Climatic zones: A, bimodal, 1000-2000 mm annual rainfall; Temperature regime: 1-2, 900-3500 m altitude
- Soil group: 4a; Soil types: Vitric Andosols: 262 (Alk2); Humic Nitisols: 271 (Alk1); Sandy Eutric Nitosol: 321 (Alk1)
- Farming system: Coffee, banana (1)
- Farming system group: 2c1
- Topography: steep slopes
- Proportion of cultivated land: very high; Carrying capacity: very high
- Dependency on soil available moisture: low; Drought risk: low to moderate; Length of growing season: 5-11 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: erosion, acidity, soil depth, fertility

Vo-2Mbozi plateau

- Mapping unit: B1d
- Geology, parent material: gneiss, volcanic ash
- Climatic zones: B, monomodal, 800-1200 mm annual rainfall; Temperature regime: 1, 1200-1800 m altitude
- Soil group: 2; Soil types: Humic/Mollic Andosols: 264; Ferric Acrisols: 478
- Farming system: Coffee-Maize-Bean (1), coffee estates
- Farming system group: 1d2
- Topography: undulating to rolling
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: high; Drought risk: low; Length of growing season: 6-9 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: fertility, erosion, capping/surface sealing

Vo-3Meru, Kilimanjaro plains, Karatu plateau

- Associated zones: Vo-1c, Vo-4c, Vo-5a, Vo-5b, Vo-6
- Mapping units: B1a1, B1a2, B2b1, B2b2
- Geology, parent material: volcanic ash (Plio-Pleistocene 8v and Sub-recent (3v))
- Climatic zones: B, transitional to bimodal, 800 to more than 1000 mm annual rainfall; Temperature regime: 1-2, 900-2500 m altitude
- Soil group: 4a; Soil types: Very shallow Phaeozem/Vitric Andosols: 102; Shallow Vitric Andosols: 141; Luvic Phaeozems 231; Humic Nitisols: 271; Sandy Eutric Nitosols: 321
- Farming systems: Maize-Bean (1a,1b) and Maize-Potato (1b)
- Farming system group: 2c1
- Topography: gently undulating to rolling to hilly, locally dissected

- Proportion of cultivated land: medium to very high; Carrying capacity: low to very high (depending on actual rainfall)
- Dependency on soil available moisture: moderate to high; Drought risk: low to high; Length of growing season: 3-6 months
- Constraints:
 - Climatic: radiation, temperature, drought
 - Soils: wind and water erosion, soil depth (drought stress), soil degradation (gully erosion), fertility, acidity?

Vo-4a

Volcanic Southern highlands Mbeya stepped plain

- Associated zones: Vo-1a, Vo-1b
- Mapping unit: Clc
- Geology, parent material: Pleistocene (4v) volcanic ash, basalt
- Climatic zones: C, monomodal, 600-1500 mm annual rainfall; Temperature regime: 1, 1200-1900 m altitude
- Soil group: 1b; Soil types: Humic/Mollic Andosols: 265
- Farming system: Maize-Bean (4c)
- Farming system group: 2a2
- Topography: undulating to rolling, some dissection
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: high; Drought risk: low; Length of growing season: 6-9 months
- Constraints:
 - Climatic: radiation, temperature
 - Soils: erosion, fertility

Vo-4b

Tarime highlands

- Mapping unit: Cla
- Geology, parent material: volcanic phonolites (Miocene)
- Climatic zones: C, bimodal, 800-1200 + annual rainfall; Temperature regime: 1, 1500-1800 m altitude
- Soil group: 6; Soil types: Humic Nitisols: 273; Ferralsols: 361; Moderately leached Luvi/Acri/Cambisols: 411 [This zone can also be placed in the Gneiss group]
- Farming system: Maize, cassava, sorghum, banana, bean, (horticulture)
- Farming system group: 1i1
- Topography: undulating to rolling
- Proportion of cultivated land: very high; Carrying capacity: high
- Dependency on soil available moisture: low; Drought risk: low to high; Length of growing season: 6-10 months
- Constraints:
 - Climatic; drought, radiation, temperature
 - Soils: fertility, erosion, acidity, low organic matter content, soil degradation (gully erosion)

Vo-4c

West Serengeti

- Associated zones: Vo-1c, Vo-3, Vo-5a, Vo-5b, Vo-6
- Mapping unit: C2e
- Geology, parent material: volcanic ash (Plio-Pleistocene 7v)
- Climatic zones: C, bimodal, 600-1000 mm annual rainfall; Temperature regime: 2, less than 1000 m altitude?

- Soil group: 4b; Soil types: Luvic Phaeozems: 232; Mollic Solonetz: 252
- Farming system/land use system: Pastoralism (1a)
- Farming system group: 2k1
- Topography: gently undulating to rolling
- Proportion of cultivated land: very low; Carrying capacity: variable
- Dependency on soil available moisture: nd; Drought risk: low to high
- Constraints:
 - Climatic: drought
 - Soils: fertility, acidity, erosion, soil degradation (gully erosion)

Vo-5a

Serengeti

- Associated zones: Vo-1c, Vo-3, Vo-4c, Vo-5b, Vo-6
- Mapping units: D1e, D2h1, D2h3
- Geology, parent material: volcanic ash (Plio-Pleistocene 7v)
- Climatic zones: D, bimodal, 600-800 mm annual rainfall; Temperature regime: 1(-2), 500-1000 m altitude and above
- Soil group: 4b; Soil types: Luvic Phaeozems: 231, 232; Mollic Solonetz: 251+252; Humic/Mollic Andosols: 261a; Vertisols: 732; 734
- Farming systems/land use systems: Park (1a), Pastoralism (1a)
- Farming system group: 2k1
- Topography: nd
- Proportion of cultivated land: very low; Carrying capacity: variable ?
- Dependency on soil available moisture: nd; Drought risk: low to high
- Constraints:
 - Climatic: drought, temperature
 - Soils: soil degradation (gully erosion), sodicity

Vo-5b

Northern lowlands, Hanang, Babati

- Associated zones: Vo-1c, Vo-3, Vo-4c, Vo-5a, Vo-6
- Mapping units: D2h2, D2k1, D2k2, D2k3, D2l
- Geology, parent material: volcanic ash (Sub-recent (3v), Plio-Pleistocene (7v, 8v))
- Climatic zones: D, transitional, 550-800/1000 mm annual rainfall; Temperature regime: 1-2, 500-1700 m altitude
- Soil group: 4a; Soil types: Very shallow Phaeozem/Vitric Andosols: 101; Shallow Vitric Andosols: 142; Luvic Phaeozems: 231; Vitric Andosols: 262 (D2k3); Sandy Eutric Nitosols: 321 (D2l); Vertisols: 734
- Farming systems: Maize-Bean-Pastoralism or Wheat-Barley-Maize-Bean-Pigeon pea or Pastoralism (1a) or Park (1a), sugarcane estate
- Farming system groups: 2c1
- Topography: gently undulating to rolling
- Proportion of cultivated land: low (?), medium to very high; Carrying capacity: low
- Dependency on soil available moisture: variable; Drought risk: low to high; Length of growing season: 2-3.5 months
- Constraints:
 - Climatic: drought

- Soils: soil degradation (gully erosion), soil depth (drought stress), sodicity, fertility, wind erosion

Vo-5c

Pangani river valley

- Mapping unit: D2p2
- Geology, parent material: stream deposits (Sub-recent (1))
- Climatic zones: D, bimodal, 500-600 mm annual rainfall; Temperature regime: 2(-3)
- Soil group: 16; Soil types: Imperfectly to poorly drained Vertisols: 724; Salty and/or sodic soils: 762. [This zone can also be placed in the Gneiss group]
- Farming system: Rice-Maize-Sweet potato
- Farming system group: 1j1
- Topography: flat
- Proportion of cultivated land: very low (medium?); Carrying capacity: very low
- Dependency on soil available moisture: low; Drought risk: moderate to very high; Length of growing season: < 2 months, but depending on flooding
- Constraints:
 - Climatic: drought
 - Soils: salinity, sodicity, workability, flooding, drainage, fertility, soil degradation (gully erosion)

Vo-6

Northern steppes, Serengeti

- Associated zones: Vo-1c, Vo-3, Vo-4c, Vo-5a, Vo-5b
- Mapping units: Ef1, Ef2, Ef3, Ef4a, Ef4b, Ef4c, Ef5
- Geology, parent material: volcanic ash (Sub-recent (3v), Plio-Pleistocene (7v, 8v), Pliocene)
- Climatic zones: E, bimodal-transitional, 400-600 mm annual rainfall; Temperature regime: 1-2, 1200 m altitude?
- Soil group: 4b; Soil types: Very shallow Phaeozem/Vitric Andosols: 102; Shallow Vitric Andosols: 141; 142+143; Luvic Phaeozems: 231; 232+233+235; Vitric Andosols: 261a; 262+263; Humic Nitisols: 271; Vertisols: 733; 734; Histosols: 782
- Farming systems: Pastoralism (1b), Park (1a)
- Farming system group: 2k1
- Topography: gently undulating to rolling
- Proportion of cultivated land: low, none; Carrying capacity: low
- Dependency on soil available moisture: nd; Drought risk: high
- Constraints:
 - Climatic: drought
 - Soils: workability, salinity, sodicity, soil degradation (gully erosion)

Annex 1. Database

4 pages

B1c	Me-3	Me-I	1e1		MFm1a		MFm	25a		25 s2	D5	1?	m	5-9	l	h	m	h	m-h
B1d	Vo-2	Vo-I	1d1		CMB1	coffee	CMB	2		2 s1	B3	1	no data	6-9	no data	vh	h	h	vh
B1e	Ka-3a	Ka-I	1d1		MB3		MB	7b		7 s2	D3	1	m-t	6.5-8	l	h	m	m	l-vh
B1f	Ka-3b	Ka-II	2b1		CR		CR	29a		29 s2	K4	1?							
B2a1	Me-4a	Me-I	1e1		MFm1a		MFm	25a		25 s2	D4	1-2?	m	5-7	l	h	m	h	l-h
B2a2	Me-4a	Me-I	1e1		MFm1a		MFm	25a		25 s2	D4								
B2b1	Vo-3	Vo-II	2c1		MB1a		MB	4a		4 s2	E1	1-2	b	3-6	h	h-vh(vh)	h-vh	h	h
B2b2	Vo-3	Vo-II	2c1		MB1a		MB	4a		4 s2	E1		b		h				
B2c	Gn-3	Gn	2c2		MB2		MB	5a		5 s1		1-2	no data	no data	no data	?	?	?	vl
B2d1	Me-4a	Me-I	2g1		TP1a		TP	25e		25 s2	K3	2	m	5-6	l	l?	l	u	l-m
B2d2	Me-4a	Me-I	2d2		MFm1b		MFm	25d		25 s2	K3	1-2	m	4-6.5	l-m	?	?	?	?
B2d3	Me-4a	Me-I	2b3		MB2		MB	25c		25 s2	K3	2	m	5-6	l-m	l	l	u	m
B2d4	Me-4a	Me-I	2b3		MS2		MS	25c		25 s2	K3	2	m	5-6	l-m	l	l	u	m
B2e1	Ka-4b	Ka-I	2h1		ML1a	s/cane	ML	10		10 s2	F1	2	b	9-12	l	h	m	c	l-m?
B2e2	Lw-2b	Lw-II	2h1		ML1b		ML	10		10 s2	B3	2	b	4-5	m?	vh	l?	u	m-h?
B2f1	Ka-4c	Ka-II	2b1		TP1a		TP	29a		29 s1	K4	2	m	6-7.5	no data	l	l	m	l-m
B2f2	Ka-4c	Ka-II	2b1		B		B	29a		29 s1	F2	2	t?	4-5	no data	vh	m	m	l-m
B2f3	Ka-4c	Ka-II	2b1		TP1a		TP	29a		29 s1	K4	2	m	5-6?		l	l	m	?
B2f4	Ka-4c	Ka-II	2b1		CB3		CB	29a		29 s1	F2	2	t-b	6-7.5	l	h	m	m	m
B2g1	Ka-4a	Ka-I	2b2		CB3		CB	7c		7 s2		2	b-t	7-9	l	h	m	c?	h
B2g2	Ka-4a	Ka-I	2b2		B		B	7c		7 s2									
B2h	Lw-2a	Lw-I	2d1		CMB2	ML1d	CMB	17		17 s2									
B2i	Gn-3	Gn	2c2	unsure	MFo1a		MFo	5a	unsure	5 s1	B3	1-2	m	8-10	no data	vh	h?	?	l
B2j1	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	D4	2	t-m	4-6	l-m	h	l	u-m	l-h
B2j2	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	D4								
B2j3	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	K3	2	m	4-5	l-m	l?	l	u	vl
B2j4	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2									
B2k	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	D4	2	t	4-5	l-h	vh	l	m-u	l-m
B2l1	Lw-2c	Lw-II	2h2		CM1a		CM	18		18 s2	E2	2	t	3-3.5	l-h	vh	l	u	?
B2l2	La-1	La-I	2l2		RL		RL	8		8 ma	E1								
B2l3	Lw-2c	Lw-II	2h2		MSP2		MSP	18		18 s2	K3	2	m	5-6	l-m	l	l	u	l-h
B2m	Se-1	Se	2l1		MCCR		MCCR	22b		22 ma		2	m-t	3-3.5	l-m	?	?	u-m	m
B2o	Lw-1b	Lw-II	1f1		RSp		RSp	13		13 md2		2	m	5-6(flood)	l-m	vl	m	u	m-h
B2p1	Me-4b	Me-II	2m1		MSP1b		MSP	26		26 s2	K4	2	m	6-9	no data	m	h	h	l-h
B2p2	Gn-4	Gn	2f1		CMB3b		CMB	5b		5 s2	K2	2?	t?	3-5		m	m	m	vh?
B2r	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4	2	t-m	6-9	l-m	m	l	h	vl-m
B2s	Lw-1a	Ka-II	1f2		CRO		CRO	20		20 s2		2	m	6-7.5	l	vl	l	m	l-m
B2t	Ka-4c	Ka-II	1f3		CRO		CRO	29b		29 s1	K4	2	m	6-7.5	l	vl	l	m	l-m
B3a	Me-4c	Me-II	1g2		RMC	s/cane	RMC	12		12 s1	F1	3	t	5.5-8(flood)	m	h	vh	h	l-vh
B3b	Me-5b	Me-III	1h3		RMC		RMC	28		28 s3	F2	3	t	3-4.5(flood)	l-m	h	l	m	m-vh
B3c1	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4	(2)-3	t-m	4-6.5	l-m	m	m	h	l-h
B3c2	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4								
B3c3	Me-4b	Me-II	2m1		SML1a		SML	26		26 s2	D5	(2)-3	m	5-6	l	h	l	m	l-m
B3d1	Me-4b	Me-II	2m1		MSe1a		MSe	26		26 s2	D5	(2)-3	m	5-6	l	h	l	m	vl-h
B3d2	Me-4b	Me-II	2m1		MSe1a		MSe	26		26 s2	D5	(2)-3	m	5-7	l	h	l	m-h	l-m
B3f	Sa-2a	Sa-I	2i1		C1	C2	C	14		14 s3		2-3	m-t	4-6.5,5-7	l(-m)	l	l	h	l-m
B3g1	Sa-2b	Sa-II	2n1		C1	CCC	CCC	15b		15 s3		(2)-3	m-t	3-4.5	l-m	vh	l	m	l-h
B3g2	Sa-2b	Sa-II	1g1		CCC		CCC	15a		15 s3		3	m-t	3-4.5	l-m	vh	l	m	m-h
B3g3	Sa-2b	Sa-II	1g1		CCC		CCC	15a		15 s3		3	b	3-4.5, 1-2	l-h	m	l	m	l-h
B3h1	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4	3	t	4.5-6	m	m	m	h	l-m
B3h2	Me-4b	Me-II	2m1		MS2a	sisal	MS	26		26 s2	D5	3	b	3-4.5,2.5-3	l-m	vh	m	m	l-h

B3i	Me-5b	Me-III	1h3		RMC		RMC	28		28 s3	F2	3	b	3-4.5(flood)	?	h?	l	m	m-vh
B3j1	Me-5d	Me-III	1h1		RMC	sisal	RMC	23		23 s2		3	t	(4-6.5)	m	h	m	h	m-h
B3j2	Me-5d	Me-III	1h1		RMSp		RMSp	23		23 s2		3	t	3-4.5	m	l	m	m	l-m
B3k	Co-3a	Co-II	1h2		MSP2	citrus	MSP	24		24 s3	E2	3	?	3-4.5	?	vh	l	m	l-m
B3l1	Co-2b	Co-II	2j1		C1		C	27		27 s3	F2	3	m-t	3-4.5	l-m	vh	l	m	l-m
B3l2	Co-2b	Co-II	2j1		MS2a		MS	27		27 s3		3	b	3-4.5, 1-2	l-h	m	l	m	l-m
B3m1	Co-2a	Co-I	2e1		MS2a	sisal	MS	19		19 s3		3	b	3-4.5, 1-2	l-h	m	l	m	l
B3m2	Co-2a	Co-I	2e1		RCC	sisal	RCC	19		19 s3	D4	3	m-t	3-4.5	l-m	vh	l	m	l-h
C1a	Vo-4b	Gn	1i1		MS1		MS	6		6 s2	B3	1	b	6-10	l-h	vh	h	c	l-vh
C1b	Gn-5a	Gn	2a1		MFo1b		MFo	3		3 s2	K2	1							
C1c	Vo-4a	Vo-I	2a2		MB4c		MB	1b		1 s1	A3	1?	m	6-9	l	vh	h	h	vh
C1d1	Gn-5b	Gn	2c2		MB4a		MB	5a		5 s2	K2	1	m	5-6	l	m	m	h	l-m
C1d2	Gn-5b	Gn	2c2		MB4a	SF1	MBSF	5a		5 s2	K2	1?		5-6		h	l	m	l-vh
C1d3	Gn-5b	Gn	2c2		SF1		SF	5a		5 s2		(1-2)	m	5-7	l??	h?,l-m	l	h	vl
C2a1	Me-5a	Me-I	2g1		TP1a		TP	25e		25 s3		2	m	4-6	l	l	m	m-h	vl-h
C2a2	Me-5a	Me-I	2d2		MFm1b		MFm	25d		25 s3		1-2	m	5-7	no data				vl
C2b	Gn-5c	Gn	2f1		MSP1a		MSP	5b		5 s3									
C2c1	La-2	La-II	2o1		TP1b		TP	11		11 s2	K5	2	m	5-9	l-m	l	m	h	l-h
C2c2	La-2	La-II	2o1		TP1b		TP	11		11 s2	K5	2	m	5-6	l?	l	m	h	l-h
C2c3	La-2	La-II	2o1		MSP5		MSP	11		11 s2	K5	1-2	no data	no data	no data	?	?	?	vl
C2d1	Sa-3a	Sa-I	2i1		MB4b		MB	14		14 ma		2	m	5-9	l	m	l	h	l-m
C2d2	Sa-3a	Sa-I	2i1		C2		C	14		14 ma		2-3	t-m	5-7	l-m	l	l	m-h	l-m
C2e	Vo-4c	Vo-II	2k1		P1a		P	4b		4 ma		2							
C2f	Sa-3a	Sa-I	2i1		MSe1b		MSe	14		14 ma				5-7		l	l	m-h	l-m
C3a1	Me-5c	Me-II	2m1		MS2a	sisal	MS	26		26 s2		3	t-b	3-4,1-2	m	m	l	m	l-h
C3a2	Me-5c	Me-II	2m1		CM1b		CM	26		26 s2	K4	(2)-3	t-m	<4-6.5	m	m	m	h	l-h
C3b	Me-5c	Me-II	2m1		MSe1a		MSe	26		26 s2	K4	3	t-m	3-5	l-m	m	l	m	l-h
C3c	Me-5c	Me-II	2m1		MSe1a		MSe	26		26 s2	K4					m	l	m	l-h
C3d	Sa-3b	Sa-II	2n1		MS2a	CCC, sisal	MSCCC	15b		15 md2		3	b	<3-4.5, 1-2	m-h	m	l	m	l-h
C3e	Co-3a	Co-II	1h2		MSP2		MSP	24		24 s3		3	?	<3-4.5	?	vh	l	m	l-m
C3f	Co-3b	Co-II	2j1		RCC		RCC	27		27 s3	F2	3	m-t	<3-4.5	m	vh	l	m	l-m
C3g	Sa-3a	Sa-I	2i1		C2	C1	C	14		14 s3		(2)-3	t-m	<5-7	m	l	l	h	l
C3h	Me-5d	Me-III	1h1		RMSp		RMSp	23		23 s2		3	t	<3-4.5	m	l	m	m	l-m
C3i	Me-5d	Me-III	1h3		RMC		RMC	28		28 s2		3	t	<3-4.5(flood)	m	h	l	m	m-vh
D1a	Me-6a	Me-I	2d2		MFm2		MFm	25d		25 s2	D5	1	m	5-6.5	l-m	h	m	h	l-h
D1b1	Gn-6a	Gn	2c2		MB4a	SF1	MBSF	5a		5 s2	C2	1	m	5-6	l?	h	l	m	l-vh
D1b2	Gn-6a	Gn	2c2		MB4a	SF1	MBSF	5a		5 s2									
D1c	Lw-3a	Lw-I	2d1		ML1d		ML	17		17 s2		1	b	no data	l-m	?	m?	?	l-h
D1d1	Gn-6b	Gn	2c2		WBMBP	MB5a	WBMBP	5a		5 ma		1	t-b	3-5	l-h	m	l	m-h	vh
D1d2	Gn-6b	Gn	2f1		WBMBP		WBMBP	5b		5 ma									
D1e	Vo-5a	Vo-II	2k1		Park1a	P1a	Park	4b		4 md2		1				?	?	?	?
D2a1	Gn-6b	Gn	2f1		MB5b		MB	5b		5 ma		2	b?	2-2.5	h	h?	vl	u	vl-l
D2a2	Me-7	Me-II	2m1		MB5b	MSP4	MBSp	26		26 s3/ma		2	b	2-2.5?	l-h	?	?	?	vl-l
D2b1	Me-6b	Me-I	2g1		MSP3		MSP	25e		25 s3/md2		2	m	4-5	l-m	l	l	u-m	vl-l
D2b2	Me-6b	Me-I	2g1		MSP3		MSP	25e		25 s3/md2						l	l	u-m	l-h
D2c	Me-6b	Me-I/Gn	2g1	2f1?	MSP3		MSP	25e	5b?	25 s3/md2		2							
D2d	Lw-3a	Lw-I	2d1		ML1d		ML	17		17 s2		2	?	7-12??		h	m	c?	l-h
D2e	Gn-6b	Gn	2f1	2g1	MB5b	MSP3	MBSp	5b		5 ma		2							
D2f	Me-6b	Me-I/Gn	2g1	2f1?	MSP3		MSP	25e	5b?	25 s3/md2									
D2g	Gn-6b	Gn	2f1		MBP	bean	MBP	5b		5 ma		2	b	2-?	m-h	h?	vl	u	vl-l
D2h1	Vo-5a	Vo-II	2k1		Park1a	P1a	Park	4b		4 md2		2							

Eg2	La-4b	La-II	212		P2b		P	8		8	un								
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Annex 2. Overview of the agro-ecological zones arranged by geology and their relation with soil groups, farming system groups and farming systems and mapping units

Agro-ecological zone	Soil group	Farming system group	Farming system	Unit group
VOLCANIC ASH				
Vo-1a	1a	1a1	MP1a	A1a1
Vo-1a	1a	1a1	MP1a	A1a2
Vo-1a	1a	1a1	MP1a	A1g1
Vo-1a	1a	1a1	MP1a	A1g2
Vo-1a	1a, 1b	1a1 (2a2)	MP1a	A1c
Vo-1a	1b	2a2	MP1a	A1b
Vo-1b	1b	2a2	CB1	A1h1
Vo-1b	1b	2a2	CB1	A1h2
Vo-1c	4a	2c1	CB1	A1k1
Vo-1c	4a	2c1	CB1	A1k2
Vo-2	2	1d2	CMB1, coffee	B1d
Vo-3	4a	2c1	MP1b	B1a1
Vo-3	4a	2c1	MB1b	B1a2
Vo-3	4a	2c1	MB1a	B2b1
Vo-3	4a	2c1	MB1a	B2b2
Vo-4a	1b	2a2	MB4c	C1c
Vo-4b	6	1i1	MS1	C1a
Vo-4c	4b	2k1	P1a	C2e
Vo-5a	4b	2k1	Park1a, P1a	D1e
Vo-5a	4b	2k1	Park1a, P1a	D2h1
Vo-5a	4b	2k1	Park1a	D2h3
Vo-5b	4a	2c1	MBP	D2h2
Vo-5b	4a	2c1	WBMBP	D2k1
Vo-5b	4a	2c1	MBP	D2k3
Vo-5b	4a	2c1	MBP, s/cane	D2l
Vo-5b	4a	none (2c1)	Bare	D2k2
Vo-5c	16	1j1	RMSp	D2p2
Vo-6	4b	2k1	Park1a, P1b	Ef1
Vo-6	4b	2k1	P1b	Ef2
Vo-6	4b	2k1	Park1a	Ef3
Vo-6	4b	2k1	P1b	Ef4a
Vo-6	4b	2k1	P1b	Ef4c
Vo-6	4b	2k1	P1b	Ef5
Vo-6	4b	none	Bare	Ef4b
GNEISS				
Gn-1a	3	2a1	CB2	A1h3
Gn-1b	5a	2c2	MFo1a	A1d1
Gn-1b	5a	2c2	MFo1a	A1d2
Gn-1b	5a	2c2	MP2	A1d3
Gn-1b	5a	2c2	MB2	A1d4
Gn-1b	5a	2c2	MB2	A1d5
Gn-1b	5a	2c2	MB2, tea	A1d6
Gn-1b	5a	2c2	MB2	A1d7
Gn-1b	5a	2c2	CMB3a	A1j1
Gn-1b	5a	2c2	MB2	A1j2
Gn-1b	5a	2c2	MP2	A1j3
Gn-2	5a	2c2	MB2	A2d1
Gn-2	5a	2c2	MP2	A2d2
Gn-2	5a	2c2	MB2	A2d3
Gn-2	5a	2c2	MFo1a	A2d5
Gn-2	5a	2c2	MB2	A2d7
Gn-2	5a	2c2 (2i1)	MB2, C1	A2d6

Gn-3	5a	2c2	MB2, MP2	B1b1
Gn-3	5a	2c2	MP2, tea, wattle	B1b2
Gn-3	5a	2c2	CB2, MB2	B1b3
Gn-3	5a	2c2	MP2	B1b4
Gn-3	5a	2c2	MB2	B1b5
Gn-3	5a	2c2	MB2	B1b6
Gn-3	5a	2c2	MB2	B2c
Gn-3	5a?	2c2?	MF01a	B2i
Gn-4	5b	2f1	CMB3b	B2p2
Gn-5a	3	2a1	MF01b	C1b
Gn-5b	5a	2c2	MB4a	C1d1
Gn-5b	5a	2c2	MB4a, SF1	C1d2
Gn-5b	5a	2c2	SF1	C1d3
Gn-5c	5b	2f1	MSP1a	C2b
Gn-6a	5a	2c2	MB4a, SF1	D1b1
Gn-6a	5a	2c2	MB4a, SF1	D1b2
Gn-6b	5a	2c2	WBMBP, MB5a	D1d1
Gn-6b	5b	2f1	WBMBP	D1d2
Gn-6b	5b	2f1	MB5b	D2a1
Gn-6b	5b	2f1	MB5b	D2m1
Gn-6b	5b	2f1	MB5b, sisal	D2m2
Gn-6b	5b	2f1 (2g1)	MB5b, MSP3	D2e
Gn-6b	5b, (4a?)	2f1 (2c1)	WBMBP	D2k4
Gn-6b	5b, (4a?)	2f1 (2c1)	MBP, bean	D2g
Gn-7	5b	2f1	P2b	Eb1
Gn-7	5b	2f1	P2b	Eb2
Gn-7	5b	2f1	Park1c	Ec2
Gn-7	5b	2f1	P2b	Ed1

METAMORPHIC AND SEDIMENTARY ROCKS (Bukoban and Karagwe-Ankolean metamorphic and sedimentary rocks)

Ka-1	7a	1a2	CMB2	A1e
Ka-1	7c	2b2	CMB2	A1f
Ka-2	29a	2b1	CB3, tea	A2a1
Ka-2	29a	2b1	CB3	A2a2
Ka-3a	7b	1d1	MB3	B1e
Ka-3b	29a	2b1	CR	B1f
Ka-4a	7c	2b2	CB3	B2g1
Ka-4a	7c	2b2	B	B2g2
Ka-4b	10	2h1	ML1a, s/cane	B2e1
Ka-4b	10	2h1	ML1c	D2p3
Ka-4c	29a	2b1	TP1a	B2f1
Ka-4c	29a	2b1	B	B2f2
Ka-4c	29a	2b1	TP1a	B2f3
Ka-4c	29a	2b1	CB3	B2f4
Ka-4c	29b	1f3	CRO	B2t

LACUSTRINE SEDIMENTS (lacustrine, wash and alluvial)

La-1	8	2l2	RL	B2l2
La-2	11	2o1	TP1b	C2c1
La-2	11	2o1	TP1b	C2c2
La-2	11	2o1	MSP5	C2c3
La-3	8	2l2	CS	D2o1
La-3	8	2l2	P2b	D2o2
La-3	8	2l2	CSP	D2o3
La-4a	8	2l2	P2b	Eg2
La-4b	11	2o1	RP1, rice	Ee2
La-4b	11	2o1	MSP5	Ee3
La-4b	11	2o1	MSP5	Ee4
La-4b	11	2o1 (1k2)	MSP5, P2a	Ee1

SANDSTONE (Karoo sandstone and shale and Jurassic-Paleogene sandstone, shale and limestone)

Sa-1	14	2i1	C1	A2f
Sa-1	14	2i1	MF01a	A2g
Sa-2a	14	2i1	C1, C2	B3f
Sa-2b	15a	1g1	CCC	B3g2
Sa-2b	15a	1g1	CCC	B3g3
Sa-2b	15b	2n1	C1, CCC	B3g1
Sa-3a	14	2i1	MB4b	C2d1
Sa-3a	14	2i1	C2	C2d2
Sa-3a	14	2i1	MSe1b	C2f
Sa-3a	14	2i1	C2, C1	C3g
Sa-3b	15b	2n1	MS2a, CCC, sisal	C3d
Sa-4	14	2i1	MB4b	D2i
Sa-5	14	2i1	Park1b	D3c

VARIOUS ROCKS AND SEDIMENTS (metamorphic, igneous and sedimentary rocks and Pleistocene and more recent alluvial and lacustrine sediments)

Lw-1a	20	1f2	CRO	B2s
Lw-1b	13	1f1	RSp	B2o
Lw-2a	17	2d1	CMB2, ML1d	B2h
Lw-2b	10	2h1	ML1b	B2e2
Lw-2c	18	2h2	CM1a	B211
Lw-2c	18	2h2	MSP2	B213
Lw-3a	17	2d1	ML1d	D1c
Lw-3a	17	2d1	ML1d	D2d
Lw-3b	18	2h2	MGL	D2r2
Lw-3b	18	2h2	MGL	D2r3
Lw-3b	18	2h2 (212)	S	D2r1

VARIOUS SEDIMENTS (lacustrine, alluvial, wash)

Se-1	22b	211	MCCR	B2m
Se-2	22a	1j2	RSM	D2s
Se-2	22b	211	CSP	D2p1
Se-3a	22b	211	RP2	Ea1
Se-3b	21a	1k2	P2a	Ea2
Se-3b	21a	1k2	P2a	Ed2
Se-3b	21a	1k2	P2a	Eg1
Se-3b	21a	1k2 (1k1, 2g1)	MGL, MSP5, P2a	Ec1
Se-3b	21b	1k1	MSP5	Eb3
Se-3b	21b	1k1	RP1	Eb4

GNEISS, GRANITE, SCHIST

Me-1	25c	2b3	MB2	A1i
Me-2a	25b	1b1	CR	A2e
Me-2a	25b?	1b1	CR	A2d4
Me-2a	25c	2b3	MB2	A2c
Me-2b	25e	2g1	MCCR	A2b
Me-2c	9	1c1	RC	A3a
Me-3	25a	1e1	MFm1a	B1c
Me-4a	25a	1e1	MFm1a	B2a1
Me-4a	25a	1e1	MFm1a	B2a2
Me-4a	25c	2b3	MB2	B2d3
Me-4a	25c	2b3	MS2	B2d4
Me-4a	25d	2d2	MFm1b	B2d2
Me-4a	25e	2g1	TP1a	B2d1
Me-4a	25e	2g1	MGTP	B2j1
Me-4a	25e	2g1	MGTP	B2j2
Me-4a	25e	2g1	MGTP	B2j3
Me-4a	25e	2g1	MGTP	B2j4
Me-4a	25e	2g1	MGTP	B2k
Me-4b	26	2m1	MSP1b	B2p1
Me-4b	26	2m1	CM1b	B2r
Me-4b	26	2m1	CM1b	B3c1

Me-4b	26	2m1	CM1b	B3c2
Me-4b	26	2m1	SML1a	B3c3
Me-4b	26	2m1	MSela	B3d1
Me-4b	26	2m1	MSela	B3d2
Me-4b	26	2m1	CM1b	B3h1
Me-4c	12	1g2	RMC, s/cane	B3a
Me-4b	26	2m1	MS2a, sisal	B3h2
Me-5a	25d	2d2	MFm1b	C2a2
Me-5a	25e	2g1	TP1a	C2a1
Me-5b	28	1h3	RMC	B3b
Me-5b	28	1h3	RMC	B3i
Me-5c	26	2m1	MS2a, sisal	C3a1
Me-5c	26	2m1	CM1b	C3a2
Me-5c	26	2m1	MSela	C3b
Me-5c	26	2m1	MSela	C3c
Me-5d	23	1h1	RMC, sisal	B3j1
Me-5d	23	1h1	RMSp	B3j2
Me-5d	23	1h1	RMSp	C3h
Me-5d	28	1h3	RMC	C3i
Me-6a	25d	2d2	MFm2	D1a
Me-6b	25e	2g1	MSP3	D2b1
Me-6b	25e	2g1	MSP3	D2b2
Me-6b	25e	2g1	MSP3	D2c
Me-6b	25e	2g1	MSP3	D2f
Me-6b	25e	2g1	CSP	D2n
Me-6b	25e	2g1	MGL	D2q1
Me-6b	25e	2g1	MGL	D2q2
Me-6b	25e	2g1	MGL	D2q3
Me-6b	25e	2g1	MGL	D2q4
Me-7	26	2m1	MB5b, MSP4	D2a2
Me-7	26	2m1	SML1b, ranching	D3a
Me-7	26	2m1	MSP4	D3b1
Me-7	26	2m1	MSP4	D3b2
COAST (Coastal sediments)				
Co-1a	19	2e1	CT	A3c
Co-1b	27	2j1	CT	A3b
Co-2a	19	2e1	MS2a, sisal	B3m1
Co-2a	19	2e1	RCC, sisal	B3m2
Co-2b	27	2j1	C1	B3l1
Co-2b	27	2j1	MS2a	B3l2
Co-3a	24	1h2	MSP2, citrus	B3k
Co-3a	24	1h2	MSP2	C3e
Co-3b	27	2j1	RCC	C3f

B1c	Me-3	Me-I	1e1		MFm1a		MFm	25a		25 s2	D5	1?	m	5-9	l	h	m	h	m-h
B1d	Vo-2	Vo-I	1d1		CMB1	coffee	CMB	2		2 s1	B3	1	no data	6-9	no data	vh	h	h	vh
B1e	Ka-3a	Ka-I	1d1		MB3		MB	7b		7 s2	D3	1	m-t	6.5-8	l	h	m	m	l-vh
B1f	Ka-3b	Ka-II	2b1		CR		CR	29a		29 s2	K4	1?							
B2a1	Me-4a	Me-I	1e1		MFm1a		MFm	25a		25 s2	D4	1-2?	m	5-7	l	h	m	h	l-h
B2a2	Me-4a	Me-I	1e1		MFm1a		MFm	25a		25 s2	D4								
B2b1	Vo-3	Vo-II	2c1		MB1a		MB	4a		4 s2	E1	1-2	b	3-6	h	h-vh(vh)	h-vh	h	h
B2b2	Vo-3	Vo-II	2c1		MB1a		MB	4a		4 s2	E1		b		h				
B2c	Gn-3	Gn	2c2		MB2		MB	5a		5 s1		1-2	no data	no data	no data	?	?	?	vl
B2d1	Me-4a	Me-I	2g1		TP1a		TP	25e		25 s2	K3	2	m	5-6	l	l?	l	u	l-m
B2d2	Me-4a	Me-I	2d2		MFm1b		MFm	25d		25 s2	K3	1-2	m	4-6.5	l-m	?	?	?	?
B2d3	Me-4a	Me-I	2b3		MB2		MB	25c		25 s2	K3	2	m	5-6	l-m	l	l	u	m
B2d4	Me-4a	Me-I	2b3		MS2		MS	25c		25 s2	K3	2	m	5-6	l-m	l	l	u	m
B2e1	Ka-4b	Ka-I	2h1		ML1a	s/cane	ML	10		10 s2	F1	2	b	9-12	l	h	m	c	l-m?
B2e2	Lw-2b	Lw-II	2h1		ML1b		ML	10		10 s2	B3	2	b	4-5	m?	vh	l?	u	m-h?
B2f1	Ka-4c	Ka-II	2b1		TP1a		TP	29a		29 s1	K4	2	m	6-7.5	no data	l	l	m	l-m
B2f2	Ka-4c	Ka-II	2b1		B		B	29a		29 s1	F2	2	t?	4-5	no data	vh	m	m	l-m
B2f3	Ka-4c	Ka-II	2b1		TP1a		TP	29a		29 s1	K4	2	m	5-6?		l	l	m	?
B2f4	Ka-4c	Ka-II	2b1		CB3		CB	29a		29 s1	F2	2	t-b	6-7.5	l	h	m	m	m
B2g1	Ka-4a	Ka-I	2b2		CB3		CB	7c		7 s2		2	b-t	7-9	l	h	m	c?	h
B2g2	Ka-4a	Ka-I	2b2		B		B	7c		7 s2									
B2h	Lw-2a	Lw-I	2d1		CMB2	ML1d	CMB	17		17 s2									
B2i	Gn-3	Gn	2c2	unsure	MFo1a		MFo	5a	unsure	5 s1	B3	1-2	m	8-10	no data	vh	h?	?	l
B2j1	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	D4	2	t-m	4-6	l-m	h	l	u-m	l-h
B2j2	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	D4								
B2j3	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	K3	2	m	4-5	l-m	l?	l	u	vl
B2j4	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2									
B2k	Me-4a	Me-I	2g1		MGTP		MGTP	25e		25 s2	D4	2	t	4-5	l-h	vh	l	m-u	l-m
B2l1	Lw-2c	Lw-II	2h2		CM1a		CM	18		18 s2	E2	2	t	3-3.5	l-h	vh	l	u	?
B2l2	La-1	La-I	2l2		RL		RL	8		8 ma	E1								
B2l3	Lw-2c	Lw-II	2h2		MSP2		MSP	18		18 s2	K3	2	m	5-6	l-m	l	l	u	l-h
B2m	Se-1	Se	2l1		MCCR		MCCR	22b		22 ma		2	m-t	3-3.5	l-m	?	?	u-m	m
B2o	Lw-1b	Lw-II	1f1		RSp		RSp	13		13 md2		2	m	5-6(flood)	l-m	vl	m	u	m-h
B2p1	Me-4b	Me-II	2m1		MSP1b		MSP	26		26 s2	K4	2	m	6-9	no data	m	h	h	l-h
B2p2	Gn-4	Gn	2f1		CMB3b		CMB	5b		5 s2	K2	2?	t?	3-5		m	m	m	vh?
B2r	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4	2	t-m	6-9	l-m	m	l	h	vl-m
B2s	Lw-1a	Ka-II	1f2		CRO		CRO	20		20 s2		2	m	6-7.5	l	vl	l	m	l-m
B2t	Ka-4c	Ka-II	1f3		CRO		CRO	29b		29 s1	K4	2	m	6-7.5	l	vl	l	m	l-m
B3a	Me-4c	Me-II	1g2		RMC	s/cane	RMC	12		12 s1	F1	3	t	5.5-8(flood)	m	h	vh	h	l-vh
B3b	Me-5b	Me-III	1h3		RMC		RMC	28		28 s3	F2	3	t	3-4.5(flood)	l-m	h	l	m	m-vh
B3c1	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4	(2)-3	t-m	4-6.5	l-m	m	m	h	l-h
B3c2	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4								
B3c3	Me-4b	Me-II	2m1		SML1a		SML	26		26 s2	D5	(2)-3	m	5-6	l	h	l	m	l-m
B3d1	Me-4b	Me-II	2m1		MSe1a		MSe	26		26 s2	D5	(2)-3	m	5-6	l	h	l	m	vl-h
B3d2	Me-4b	Me-II	2m1		MSe1a		MSe	26		26 s2	D5	(2)-3	m	5-7	l	h	l	m-h	l-m
B3f	Sa-2a	Sa-I	2i1		C1	C2	C	14		14 s3		2-3	m-t	4-6.5,5-7	l(-m)	l	l	h	l-m
B3g1	Sa-2b	Sa-II	2n1		C1	CCC	CCC	15b		15 s3		(2)-3	m-t	3-4.5	l-m	vh	l	m	l-h
B3g2	Sa-2b	Sa-II	1g1		CCC		CCC	15a		15 s3		3	m-t	3-4.5	l-m	vh	l	m	m-h
B3g3	Sa-2b	Sa-II	1g1		CCC		CCC	15a		15 s3		3	b	3-4.5, 1-2	l-h	m	l	m	l-h
B3h1	Me-4b	Me-II	2m1		CM1b		CM	26		26 s2	K4	3	t	4.5-6	m	m	m	h	l-m
B3h2	Me-4b	Me-II	2m1		MS2a	sisal	MS	26		26 s2	D5	3	b	3-4.5,2.5-3	l-m	vh	m	m	l-h

B3i	Me-5b	Me-III	1h3		RMC		RMC	28		28 s3	F2	3	b	3-4.5(flood)	?	h?	l	m	m-vh
B3j1	Me-5d	Me-III	1h1		RMC	sisal	RMC	23		23 s2		3	t	(4-6.5)	m	h	m	h	m-h
B3j2	Me-5d	Me-III	1h1		RMSp		RMSp	23		23 s2		3	t	3-4.5	m	l	m	m	l-m
B3k	Co-3a	Co-II	1h2		MSP2	citrus	MSP	24		24 s3	E2	3	?	3-4.5	?	vh	l	m	l-m
B3l1	Co-2b	Co-II	2j1		C1		C	27		27 s3	F2	3	m-t	3-4.5	l-m	vh	l	m	l-m
B3l2	Co-2b	Co-II	2j1		MS2a		MS	27		27 s3		3	b	3-4.5, 1-2	l-h	m	l	m	l-m
B3m1	Co-2a	Co-I	2e1		MS2a	sisal	MS	19		19 s3		3	b	3-4.5, 1-2	l-h	m	l	m	l
B3m2	Co-2a	Co-I	2e1		RCC	sisal	RCC	19		19 s3	D4	3	m-t	3-4.5	l-m	vh	l	m	l-h
C1a	Vo-4b	Gn	1i1		MS1		MS	6		6 s2	B3	1	b	6-10	l-h	vh	h	c	l-vh
C1b	Gn-5a	Gn	2a1		MFo1b		MFo	3		3 s2	K2	1							
C1c	Vo-4a	Vo-I	2a2		MB4c		MB	1b		1 s1	A3	1?	m	6-9	l	vh	h	h	vh
C1d1	Gn-5b	Gn	2c2		MB4a		MB	5a		5 s2	K2	1	m	5-6	l	m	m	h	l-m
C1d2	Gn-5b	Gn	2c2		MB4a	SF1	MBSF	5a		5 s2	K2	1?		5-6		h	l	m	l-vh
C1d3	Gn-5b	Gn	2c2		SF1		SF	5a		5 s2		(1-)	m	5-7	l??	h?,l-m	l	h	vl
C2a1	Me-5a	Me-I	2g1		TP1a		TP	25e		25 s3		2	m	4-6	l	l	m	m-h	vl-h
C2a2	Me-5a	Me-I	2d2		MFm1b		MFm	25d		25 s3		1-2	m	5-7	no data				vl
C2b	Gn-5c	Gn	2f1		MSP1a		MSP	5b		5 s3									
C2c1	La-2	La-II	2o1		TP1b		TP	11		11 s2	K5	2	m	5-9	l-m	l	m	h	l-h
C2c2	La-2	La-II	2o1		TP1b		TP	11		11 s2	K5	2	m	5-6	l?	l	m	h	l-h
C2c3	La-2	La-II	2o1		MSP5		MSP	11		11 s2	K5	1-2	no data	no data	no data	?	?	?	vl
C2d1	Sa-3a	Sa-I	2i1		MB4b		MB	14		14 ma		2	m	5-9	l	m	l	h	l-m
C2d2	Sa-3a	Sa-I	2i1		C2		C	14		14 ma		2-3	t-m	5-7	l-m	l	l	m-h	l-m
C2e	Vo-4c	Vo-II	2k1		P1a		P	4b		4 ma		2							
C2f	Sa-3a	Sa-I	2i1		MSe1b		MSe	14		14 ma				5-7		l	l	m-h	l-m
C3a1	Me-5c	Me-II	2m1		MS2a	sisal	MS	26		26 s2		3	t-b	3-4,1-2	m	m	l	m	l-h
C3a2	Me-5c	Me-II	2m1		CM1b		CM	26		26 s2	K4	(2)-3	t-m	<4-6.5	m	m	m	h	l-h
C3b	Me-5c	Me-II	2m1		MSe1a		MSe	26		26 s2	K4	3	t-m	3-5	l-m	m	l	m	l-h
C3c	Me-5c	Me-II	2m1		MSe1a		MSe	26		26 s2	K4					m	l	m	l-h
C3d	Sa-3b	Sa-II	2n1		MS2a	CCC, sisal	MSCCC	15b		15 md2		3	b	<3-4.5, 1-2	m-h	m	l	m	l-h
C3e	Co-3a	Co-II	1h2		MSP2		MSP	24		24 s3		3	?	<3-4.5	?	vh	l	m	l-m
C3f	Co-3b	Co-II	2j1		RCC		RCC	27		27 s3	F2	3	m-t	<3-4.5	m	vh	l	m	l-m
C3g	Sa-3a	Sa-I	2i1		C2	C1	C	14		14 s3		(2)-3	t-m	<5-7	m	l	l	h	l
C3h	Me-5d	Me-III	1h1		RMSp		RMSp	23		23 s2		3	t	<3-4.5	m	l	m	m	l-m
C3i	Me-5d	Me-III	1h3		RMC		RMC	28		28 s2		3	t	<3-4.5(flood)	m	h	l	m	m-vh
D1a	Me-6a	Me-I	2d2		MFm2		MFm	25d		25 s2	D5	1	m	5-6.5	l-m	h	m	h	l-h
D1b1	Gn-6a	Gn	2c2		MB4a	SF1	MBSF	5a		5 s2	C2	1	m	5-6	l?	h	l	m	l-vh
D1b2	Gn-6a	Gn	2c2		MB4a	SF1	MBSF	5a		5 s2									
D1c	Lw-3a	Lw-I	2d1		ML1d		ML	17		17 s2		1	b	no data	l-m	?	m?	?	l-h
D1d1	Gn-6b	Gn	2c2		WBMBP	MB5a	WBMBP	5a		5 ma		1	t-b	3-5	l-h	m	l	m-h	vh
D1d2	Gn-6b	Gn	2f1		WBMBP		WBMBP	5b		5 ma									
D1e	Vo-5a	Vo-II	2k1		Park1a	P1a	Park	4b		4 md2		1				?	?	?	?
D2a1	Gn-6b	Gn	2f1		MB5b		MB	5b		5 ma		2	b?	2-2.5	h	h?	vl	u	vl-l
D2a2	Me-7	Me-II	2m1		MB5b	MSP4	MBSp	26		26 s3/ma		2	b	2-2.5?	l-h	?	?	?	vl-l
D2b1	Me-6b	Me-I	2g1		MSP3		MSP	25e		25 s3/md2		2	m	4-5	l-m	l	l	u-m	vl-l
D2b2	Me-6b	Me-I	2g1		MSP3		MSP	25e		25 s3/md2						l	l	u-m	l-h
D2c	Me-6b	Me-I/Gn	2g1	2f1?	MSP3		MSP	25e	5b?	25 s3/md2		2							
D2d	Lw-3a	Lw-I	2d1		ML1d		ML	17		17 s2		2	?	7-12??		h	m	c?	l-h
D2e	Gn-6b	Gn	2f1	2g1	MB5b	MSP3	MBSp	5b		5 ma		2							
D2f	Me-6b	Me-I/Gn	2g1	2f1?	MSP3		MSP	25e	5b?	25 s3/md2									
D2g	Gn-6b	Gn	2f1		MBP	bean	MBP	5b		5 ma		2	b	2-?	m-h	h?	vl	u	vl-l
D2h1	Vo-5a	Vo-II	2k1		Park1a	P1a	Park	4b		4 md2		2							

Eg2	La-4b	La-II	212		P2b		P	8		8	un								
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