

Fig. 1: Landscape transect of the Seronga core site with major landscape units (LSU), representative soil profiles with indication of texture classes for each horizon according to WRB (IUSS Working Group WRB 2006).

#### **Recent Floodplains (LSU 1)**

Recent Floodplains comprise a multitude of sites with different edaphic conditions. Only a few of these sites near the shoreline of the floodplains have been studied. Here, soils on the levees are Eutric Arenosols whereas in depressions Gleyic Fluvisols and Dystric Gleysols have been found.

#### Levelled Kalahari Dune Area (LSU 2)

The Kalahri Sandveld consists of two main units, the clayey sand of former floodplains (2.3) and the deep sand on degraded dunes (2.1). These units are connected by a third, very narrow transition zone (2.2). All three units have nearly identical topographic height but differ in soil types, soil colour and vegetation. The grey to dark gray soils of the former floodplains imply a soil community ranging from Eutric Arenosols to Haplic Cambisols. The reddish transition zone with Haplic Cambisols leads to the light brown to pale Dystric Arenosols of the former dunes dominated by Terminalia sericea woodland. As indicated by the texture triangle, the grain size composition of all soils is rather homogeneous and clay contents of more than 10% are an exception (Fig. 2).

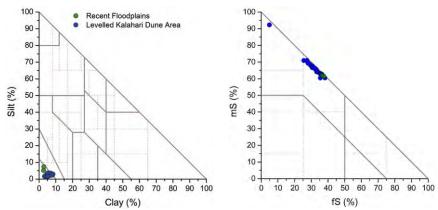


Fig. 2 a, b: Grain size distribution for all major landscapes in the Seronga core site. Figure 2 a shows the relation between clay, silt and loam. Figure 2 b shows the grain size distribution within the sand fraction.

## Table 1: Properties of selected reference soil profiles for Seronga.

Nem of LSURecent Floor (Large Constraint)Later (Large Constraint)	No. LSU	1	1 2		
Name of Sub-LSULeveeFormer FloodplainsTransition ZoneFormer DunesNo. reference profileP 2170P 2095P 2088P 2096Soil type reference profileGieyic Fluvisol, eutric, greyic, attenic dystic, hyperchric eutric, greyic, eutric, greyic, attenic types reference profileHapic Arenosol, eutric, greyic, eutric, greyic, eutric, greyic, eutric, greyic, dystic, hyperchric types reference profileHapic Arenosol, eutric, greyic, eutric, greyic, eutric, greyic, eutric, greyic, dystic, hyperchric types reference profile18,7777-18,7687-18,7687Longlude ("]22,428322,405722,437122,4229Topographic height (m a.s.l.)*980978988988Depolity poortiesTotal 10,78,3117,57K 3/210/7K 4/1Soil colour (vet)10YR 3/110YR 3/17,57K 3/210/7K 4/1Dial longranic carbon (% DW)00000Total inorganic carbon (% DW)0.4210.0640.0310.033C/N ratio10.91.310.07.24.9Plant available photassium (mg kg")0.0088.4268.4110.04Plant available photassium (mg kg")0.0088.4268.4110.49Magnesium water extract (mg kg")0.1620.0620.0650.065Soil colour (wet)10YK 5/110YR 3/27.5YR 3/410YR 4/2Mitra ie water extract (mg kg")0.01000Calcian magnesium (mg kg")0.010<	Name of LSU	<b>Recent Floodplains</b>	Levelled Kalahari Dune Area		
No. reference profileP 2170P 2086P 2088P 2086Soil type reference profileClevic Fluvisol, arenicHaplic Arenosol, autric, grayicHaplic Arenosol, Autric, autric, grayicHaplic Arenosol, Autric, autric, grayicHaplic Arenosol, Autric, autric, grayicHaplic Arenosol, Autric, autric, grayic	No. Sub-LSU	1.1	2.1	2.1	2.2
Soil type reference profile eutric, greyic, arenic eutric, greyic, arenic eutric, greyic, arenic eutric, greyic, arenic eutric, greyicHaplic Cambiaol, eutric, greyicHaplic Arenosol, dystric, hyperochric LasticeLatitude [*]-18.8279-18.7777-18.7687-18.7687Longitude [*]-22.428322.45722.437122.4229Topographic height [m a.s.],*980978988988Topal properties	Name of Sub-LSU	Levee	Former Floodplains	Transition Zone	Former Dunes
eutric greyic, areniceutric, greyiceutric, greyicdystric, hyperochricLatitude [1]1-8.82791-8.77771-8.76871-8.7687Longitude [1]22.428322.406722.437122.4223Topgoraphic height [m.a.s.],*990978988988Topgoraphic height [m.a.s.],*990978988988Topsoil properties55.13.8EC [µS cm]114292012Total organic carbon [% DW]0000Total inforgenic carbon [% DW]0.4210.0640.0310.033C/N ratio10.910.010.711.711.7Nitrate in water extract [mg kg"]0.00103.6753.3216.08Exchangeable potassium [mg kg"]0.00621.0328.44555.00Calcium water extract [mg kg"]0.00621.0328.44555.00Calcium water extract [mg kg"]0.1620.030.710.48Exchangeable calcium [mg kg"]0.01621.0328.44555.00Calcium water extract [mg kg"]0.1620.230.160.12Soli colour (wet)10YR 5/110YR 3/27.5YR 3/410YR 4/4PH (n CaCl.)4.55.03.63.8Exchangeable calcium [mg kg"]0.00621.030.063.7Soli colour (wet)10YR 5/110YR 3/27.6YR 3/410YR 4/4PH (n CaCl.)4.55.03.63.8Calcium water extract	No. reference profile	P 2170	P 2095	P 2088	P 2096
Longitud [']         22.4283         22.4057         22.4371         22.4229           Topographic height [m a.s.l.]*         980         978         988         988           Topographic height [m a.s.l.]*         980         978         988         988           Topographic height [m a.s.l.]*         10YR 3/1         7,5YR 3/2         10YR 4/1           Pl (in CaCl.)         4.6         5.3         5.1         3.8           EC [µS cm]         114         29         20         12           Total organic carbon [% DW]         4.58         0.63         0.33         0.39           Total introgen [% DW]         0         0         0         0           Total introgen [% DW]         0.421         0.064         0.031         0.033           CN ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg']         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg']         0.62         0.062         0.005           Exchangeable potassium [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.47         19.5         9.8         28 <tr< td=""><td>Soil type reference profile</td><td></td><td>•</td><td>•</td><td>•</td></tr<>	Soil type reference profile		•	•	•
Topgraphic height [m a.s.l]*         980         978         988         988           Topgraphic height [m a.s.l]*         10YR 3/1         10YR 3/1         7,5YR 3/2         10YR 4/1           pH (in CaCl,)         4.6         5.3         5.1         3.8           EC [µS cm']         114         29         20         12           Total organic carbon [% DW]         4.58         0.63         0.33         0.39           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.421         0.064         0.031         0.033           C/N ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg']         1.3         10.0         7.2         4.9           Plant available potassium [mg kg']         0.00         103.67         53.32         16.08           Plant available potassium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.00         621.03         264.45         55.00              Calcium water extract [mg kg']         0.01 </td <td>Latitude [°]</td> <td>-18.8279</td> <td>-18.7777</td> <td>-18.7687</td> <td>-18.7632</td>	Latitude [°]	-18.8279	-18.7777	-18.7687	-18.7632
Topsoil properties           Soil colour (wet)         10YR 3/1         10YR 3/1         7.5YR 3/2         10YR 4/1           pH (n CaCl.)         4.6         5.3         5.1         3.8           EC (µS cm <sup>1</sup> )         114         29         20         12           Total organic carbon (% DW)         4.58         0.63         0.33         0.39           Total norganic carbon (% DW)         0         0         0         0           Total norganic carbon (% DW)         0.421         0.064         0.031         0.033           CN ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg <sup>1</sup> ]         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg <sup>1</sup> ]         0.00         103.67         53.32         16.08           Plant available phosphorous [mg kg <sup>1</sup> ]         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg <sup>1</sup> ]         0.10         621.03         284.45         55.00           Exchangeable calcium [mg kg <sup>1</sup> ]         0.00         621.03         284.45         55.00           Soil colour (wet)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2	Longitude [°]	22.4283	22.4057	22.4371	22.4229
Soli colour (wet)         10YR 3/1         10YR 3/1         7.5YR 3/2         10YR 4/1           pH (in CaCl.)         4.6         5.3         5.1         3.8           EC [µS cm <sup>1</sup> ]         114         29         20         12           Total organic carbon [% DW]         4.58         0.63         0.33         0.39           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.421         0.064         0.031         0.033           CN ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg <sup>1</sup> ]         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg <sup>1</sup> ]         0.00         103.67         53.32         16.08           Exchangeable potassium [mg kg <sup>1</sup> ]         0.00         88.42         64.41         10.49           Magnesium water extract [mg kg <sup>1</sup> ]         0.00         621.03         284.45         55.00           Calcium water extract [mg kg <sup>1</sup> ]         0.00         621.03         284.45         55.00           Calcium water extract [mg kg <sup>1</sup> ]         0.12         0.23         0.16         0.12           Subsol properties (1 m)         10YR	Topographic height [m a.s.l.] *	980	978	988	988
pH (in CaCl.)         4.6         5.3         5.1         3.8           EC [µS cm']         114         29         20         12           Total organic carbon [% DW]         4.58         0.63         0.33         0.39           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.421         0.064         0.031         0.033           C/N ratio         10.9         10.0         7.2         4.9           Plant available phosphorous [mg kg']         38.38         25.43         10.03         14.65           Exchangeable potassium [mg kg']         0.00         103.67         53.32         16.08           Plant available potassium [mg kg']         0.00         103.67         53.32         10.09           Exchangeable magnesium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg']         24.7         19.5         9.8         2.8           Subsoil properties (1)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (n CaCl.)         4.5         5.4 <td>Topsoil properties</td> <td></td> <td></td> <td></td> <td></td>	Topsoil properties				
EC [µ]S cm <sup>2</sup> ]         114         29         20         12           Total organic carbon [% DW]         4.58         0.63         0.33         0.39           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.421         0.064         0.031         0.033           CN ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg <sup>2</sup> ]         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg <sup>2</sup> ]         0.62         0.005         16.08           Exchangeable potassium [mg kg <sup>2</sup> ]         0.162         0.089         0.052         0.005           Exchangeable potassium [mg kg <sup>2</sup> ]         0.01         621.03         284.45         55.00           Calcium water extract [mg kg <sup>2</sup> ]         24.7         19.5         11.4         1.5           Exchangeable calcium [mg kg <sup>2</sup> ]         0.00         621.03         284.45         55.00           Calcium water extract [mg kg <sup>2</sup> ]         24.7         19.5         9.8         2.8           Subcolor (wet)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in Cacl.)         4.5         5	Soil colour (wet)	10YR 3/1	10YR 3/1	7,5YR 3/2	10YR 4/1
Total organic carbon [% DW]         4.58         0.63         0.33         0.39           Total inorganic carbon [% DW]         0         0         0         0           Total initrogen [% DW]         0.421         0.064         0.031         0.033           C/N ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg']         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg']         0.00         103.67         53.32         16.08           Plant available phosphorous [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.12         0.7         5.4         3.6         3.8           Subicolour (wet)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2         17           Pl (in CaCl.)         4.5         5.4         3.6         3.8         3.6	pH (in CaCl₂)	4.6	5.3	5.1	3.8
Total inorganic carbon [% DW]         0         0         0           Total initrogen [% DW]         0.421         0.064         0.031         0.033           C/N ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg']         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg']         38.38         25.43         10.03         14.65           Exchangeable potassium [mg kg']         0.00         103.67         53.32         16.08           Plant available potassium [g kg']         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg']         0.162         0.089         0.652         0.005           Exchangeable magnesium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg']         24.7         19.5         9.8         2.8           Subsoil properties (m)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in CaCl.)         4.5         5.4         3.6         3.8           EC [µS cm']         15	EC [µS cm <sup>-1</sup> ]	114	29	20	12
Total nitrogen [% DW]         0.421         0.064         0.031         0.033           C/N ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg']         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg']         38.38         25.43         10.03         14.65           Exchangeable potassium [mg kg']         0.00         103.67         53.32         16.08           Plant available potassium [mg kg']         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in CaCl <sub>2</sub> )         4.5         5.4         3.6         3.8           EC [µS cm']         15         20         10         7           Total organic carbon [% DW]         0.12         0.25         0.016         0.014           C/N ratio <td< td=""><td>Total organic carbon [% DW]</td><td>4.58</td><td>0.63</td><td>0.33</td><td>0.39</td></td<>	Total organic carbon [% DW]	4.58	0.63	0.33	0.39
C/N ratio         10.9         10.0         10.7         11.7           Nitrate in water extract [mg kg']         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg']         38.38         25.43         10.03         14.65           Exchangeable potassium [mg kg']         0.00         103.67         53.32         16.08           Plant available potassium [mg kg']         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         5         5.4         3.6         3.8           EC [µS cm']         15         20         10         7           Total organic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5	Total inorganic carbon [% DW]	0	0	0	0
Nitrate in water extract [mg kg <sup>1</sup> ]         1.3         10.0         7.2         4.9           Plant available phosphorous [mg kg <sup>1</sup> ]         38.38         25.43         10.03         14.65           Exchangeable potassium [mg kg <sup>1</sup> ]         0.00         103.67         53.32         16.08           Plant available potassium [mg kg <sup>1</sup> ]         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg <sup>1</sup> ]         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg <sup>1</sup> ]         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg <sup>1</sup> ]         0.00         621.03         284.45         55.00           Calcium water extract [mg kg <sup>1</sup> ]         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in CaCl.)         4.5         5.4         3.6         3.8           EC [µS cm <sup>1</sup> ]         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.014           C/N ratio	Total nitrogen [% DW]	0.421	0.064	0.031	0.033
Plant available phosphorous [mg kg <sup>1</sup> ]         38.38         25.43         10.03         14.65           Exchangeable potassium [mg kg <sup>1</sup> ]         0.00         103.67         53.32         16.08           Plant available potassium [mg kg <sup>1</sup> ]         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg <sup>1</sup> ]         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg <sup>1</sup> ]         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg <sup>1</sup> ]         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg <sup>1</sup> ]         0.00         621.03         284.45         55.00           Calcium water extract [mg kg <sup>1</sup> ]         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         55.00         7.5YR 3/4         10YR 4/2           PH (in CaCl.)         4.5         5.4         3.6         3.8           EC [µS cm <sup>1</sup> ]         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>1</sup> ]	C/N ratio	10.9	10.0	10.7	11.7
Exchangeable potassium [mg kg']         0.00         103.67         53.32         16.08           Plant available potassium [g kg']         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         5         5.4         3.6         3.8           C [µS cm']         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg']         0.00         82.12         127.19         7.82           Plant available potassium [mg kg']         0.00         82.12         127.19         7.82           Plant available potassium [mg kg']	Nitrate in water extract [mg kg-1]	1.3	10.0	7.2	4.9
Plant available potassium [g kg']         0.162         0.089         0.052         0.005           Exchangeable magnesium [mg kg']         0.00         88.42         64.81         10.49           Magnesium water extract [mg kg']         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         24.7         19.5         8.8         2.8           Subsoil properties (1 m)         5         5.4         3.6         3.8           Soil colour (wet)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           PH (in CaCl <sub>2</sub> )         4.5         5.4         3.6         3.8           EC [µS cm']         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg']         10.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg']         0.00         <	Plant available phosphorous [mg kg <sup>-1</sup> ]	38.38	25.43	10.03	14.65
Exchangeable magnesium [mg kg ']0.0088.4264.8110.49Magnesium water extract [mg kg ']4.719.511.41.5Exchangeable calcium [mg kg ']0.00621.03284.4555.00Calcium water extract [mg kg ']24.719.59.82.8Subsoil properties (1 m)10YR 3/27.5YR 3/410YR 4/2Soil colour (wet)10YR 5/110YR 3/27.5YR 3/410YR 4/2pH (in CaCl <sub>2</sub> )4.55.43.63.8EC [µS cm ']1520107Total organic carbon [% DW]0.120.230.160.12Total inorganic carbon [% DW]0.0130.0250.0160.014C/N ratio9.59.410.18.3Nitrate in water extract [mg kg ']0.44.81.4n.a.Plant available potassium [mg kg ']0.0082.12127.197.82Plant available potassium [mg kg ']0.00133.7956.712.78Magnesium water extract [mg kg ']1.114.211.7n.a.Exchangeable calcium [mg kg ']0.00541.5435.726.09	Exchangeable potassium [mg kg <sup>-1</sup> ]	0.00	103.67	53.32	16.08
Magnesium water extract [mg kg']         4.7         19.5         11.4         1.5           Exchangeable calcium [mg kg']         0.00         621.03         284.45         55.00           Calcium water extract [mg kg']         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         5         5.4         3.6         3.8           EC [µS cm']         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total organic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg']         0.0         82.12         127.19         7.82           Plant available phosphorous [mg kg']         0.4         4.8         1.4         n.a.           Exchangeable potassium [mg kg']         0.00         82.12         127.19         7.82           Plant available phosphorous [mg kg']         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg']         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg']         0	Plant available potassium [g kg <sup>-1</sup> ]	0.162	0.089	0.052	0.005
Exchangeable calcium [mg kg']0.00621.03284.4555.00Calcium water extract [mg kg']24.719.59.82.8Subsoil properties (1 m)Soil colour (wet)10YR 5/110YR 3/27.5YR 3/410YR 4/2PH (in CaCl <sub>2</sub> )4.55.43.63.8EC [µS cm']1520107Total organic carbon [% DW]0.120.230.160.12Total inorganic carbon [% DW]0.0130.0250.0160.014C/N ratio9.59.410.18.3Nitrate in water extract [mg kg']0.0082.12127.197.82Plant available phosphorous [mg kg']0.0082.12127.197.82Plant available potassium [kg']0.00133.7956.712.78Magnesium water extract [mg kg']0.00541.5435.726.09	Exchangeable magnesium [mg kg <sup>-1</sup> ]	0.00	88.42	64.81	10.49
Calcium water extract [mg kg <sup>-1</sup> ]         24.7         19.5         9.8         2.8           Subsoil properties (1 m)         50         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           Soli colour (wet)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in CaCl <sub>2</sub> )         4.5         5.4         3.6         3.8           EC [µS cm <sup>-1</sup> ]         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Magnesium water extract [mg kg <sup>-1</sup> ]	4.7	19.5	11.4	1.5
Subsoil properties (1 m)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in CaCl <sub>2</sub> )         4.5         5.4         3.6         3.8           EC [µS cm']         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg']         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg']         12.51         n.a         6.52         n.a           Exchangeable potassium [mg kg']         0.00         82.12         127.19         7.82           Plant available potassium [g kg']         0.00         82.12         12.8         n.a.           Exchangeable magnesium [mg kg']         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg']         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg']         0.00	Exchangeable calcium [mg kg <sup>-1</sup> ]	0.00	621.03	284.45	55.00
Soil colour (wet)         10YR 5/1         10YR 3/2         7.5YR 3/4         10YR 4/2           pH (in CaCl <sub>2</sub> )         4.5         5.4         3.6         3.8           EC [µS cm <sup>-1</sup> ]         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09  -1]         0.00<	Calcium water extract [mg kg-1]	24.7	19.5	9.8	2.8
pH (in CaCl <sub>2</sub> )         4.5         5.4         3.6         3.8           EC [µS cm <sup>-1</sup> ]         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.12         0.23         0.16         0.12           Total nitrogen [% DW]         0         0         0         0         0           Total nitrogen [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         12.51         n.a.         6.52         n.a.           Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1	Subsoil properties (1 m)				
EC [µS cm <sup>1</sup> ]         15         20         10         7           Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0         0         0         0           Total inorganic carbon [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Soil colour (wet)	10YR 5/1	10YR 3/2	7.5YR 3/4	10YR 4/2
Total organic carbon [% DW]         0.12         0.23         0.16         0.12           Total inorganic carbon [% DW]         0	pH (in CaCl₂)	4.5	5.4	3.6	3.8
Total inorganic carbon [% DW]         0         0         0         0           Total nitrogen [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         12.51         n.a.         6.52         n.a.           Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	EC [µS cm <sup>-1</sup> ]	15	20	10	7
Total nitrogen [% DW]         0.013         0.025         0.016         0.014           C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         12.51         n.a.         6.52         n.a.           Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Total organic carbon [% DW]	0.12	0.23	0.16	0.12
C/N ratio         9.5         9.4         10.1         8.3           Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         12.51         n.a.         6.52         n.a.           Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Total inorganic carbon [% DW]	0	0	0	0
Nitrate in water extract [mg kg <sup>-1</sup> ]         0.4         4.8         1.4         n.a.           Plant available phosphorous [mg kg <sup>-1</sup> ]         12.51         n.a.         6.52         n.a.           Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Total nitrogen [% DW]	0.013	0.025	0.016	0.014
Plant available phosphorous [mg kg <sup>-1</sup> ]       12.51       n.a.       6.52       n.a.         Exchangeable potassium [mg kg <sup>-1</sup> ]       0.00       82.12       127.19       7.82         Plant available potassium [g kg <sup>-1</sup> ]       2.4       16.6       21.8       n.a.         Exchangeable magnesium [mg kg <sup>-1</sup> ]       0.00       133.79       56.71       2.78         Magnesium water extract [mg kg <sup>-1</sup> ]       1.1       14.2       11.7       n.a.         Exchangeable calcium [mg kg <sup>-1</sup> ]       0.00       541.54       35.72       6.09	C/N ratio	9.5	9.4	10.1	8.3
Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Nitrate in water extract [mg kg <sup>-1</sup> ]	0.4	4.8	1.4	n.a.
Exchangeable potassium [mg kg <sup>-1</sup> ]         0.00         82.12         127.19         7.82           Plant available potassium [g kg <sup>-1</sup> ]         2.4         16.6         21.8         n.a.           Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Plant available phosphorous [mg kg <sup>-1</sup> ]		n.a.	6.52	n.a.
Exchangeable magnesium [mg kg <sup>-1</sup> ]         0.00         133.79         56.71         2.78           Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09					
Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Plant available potassium [g kg-1]	2.4	16.6	21.8	n.a.
Magnesium water extract [mg kg <sup>-1</sup> ]         1.1         14.2         11.7         n.a.           Exchangeable calcium [mg kg <sup>-1</sup> ]         0.00         541.54         35.72         6.09	Exchangeable magnesium [mg kg <sup>-1</sup> ]	0.00	133.79	56.71	2.78
Exchangeable calcium [mg kg <sup>-1</sup> ] 0.00 541.54 35.72 6.09	Magnesium water extract [mg kg <sup>-1</sup> ]	1.1	14.2	11.7	n.a.
			541.54	35.72	6.09
					n.a.

n.a.: not analysed; \* measured by GPS

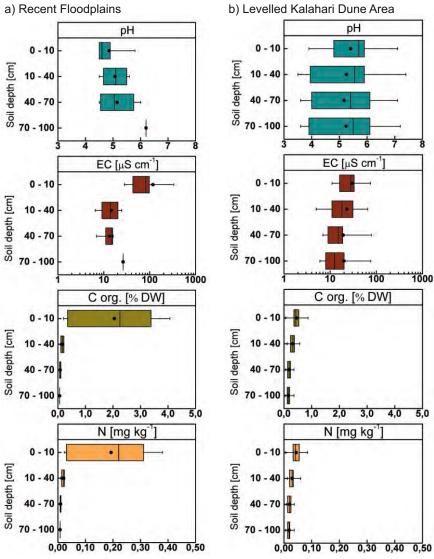


Fig. 3 a, b: Boxplots (Box: 25%, 75% percentile, mean and median; Whisker: min./max.) showing pH, electrical conductivity, organic carbon content and total nitrogen content for four depth intervals comparing LSU 1 (a) with LSU 2 (b).



Fig. 4: Installation of a soil water monitoring station on a dryland agriculture field in Seronga (photo: A. Groengroeft).

The structural division of the landscape into two main landscape units, consisting of the Panhandle's Recent Floodplains (LSU 1) and the adjacent levelled Kalahari Dune Area (LSU 2), is also reflected by the differences in the soil chemical properties (Fig. 3). Within the Recent Floodplains a variety of soils such as Histosols, Fluvisols, sandy Gleysols and Endogleyic Arenosols are characteristic but have only been partly analysed. Here, low to medium pH values and high topsoil carbon (4.1%) and nitrogen (0.38%) content are found, similar to those determined for the same unit at Mashare. However, subsoil nutrient contents are considerably lower in the Seronga floodplains due to nutrient leaching as a consequence of higher groundwater table throughout the year.

The absence of topographic features, like dry riverbeds in Seronga's levelled Kalahari Dune Area (LSU 2) leads to lower maximum values of the chemical parameters in comparison to LSU 3 at the Mashare core site. Nevertheless, mean values show a good comparability between these two core sites with slightly to strongly acidic pH values and very low organic carbon and nitrogen contents. The catena of dark coloured Cambisols to reddish to pale Arenosols, which is reflected by a typical gradient in vegetation, is characterized by a clear decline in potassium, magnesium and calcium and an increase in available zinc content.

# Acknowledgements

This study was funded by the BMBF (The Future Okavango project). For details see authors' general acknowledgements in this volume.

### Reference

IUSS Working Group WRB (2006): World Reference Base for Soil Resources 2006. World Soil Resources Report No. 103. Rome, Italy: FAO.

Responsible authors: A. Groengroeft, J. Luther-Mosebach, L. Landschreiber, A. Eschenbach