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ALTERRA is the amalgamation of the Institute for Forestry and Nature Research (IBN) and the Winand Staring Centre for Integrated Land, Soil and Water Research (SC). The merger took place on 1 January 2000.

[Special issue 2005/01]

Contents

1. Introduction

In the summer of 2003 a peat dyke at Wilnis collapsed. This summer was very dry and the main assumption about the collapse was a big loss of mass due to dehydration. As a result of the dehydration the dyke could not resist the pressure of the water and collapsed. A well known phenomenom of peat soils is that once they are dry they are hardly to wet again as a result of water repellency of the soil. A water repellent soil will be defined as one which does not wet up spontaneously when a drop of water is placed upon the surface. Water repellency is influenced by season and soil water content. In most cases, repellency decreases during winter months and is most severe during summer. This seasonal variation may be due to soil moisture conditions. Long, hot, dry periods (e.g. summer 2003) stimulate the formation of water repellent soils.

Water repellency may dramatically affect water and solute movement at the field-scale. Water repellency and its spatial variability have been shown to cause decreased infiltration of precipitation and irrigation water, non uniform wetting of soil profiles, increased runoff, and leaching due to preferential flow.

Vieffect Int. BV has commissioned Alterra to start a field trial to study the effects of VIMI-X on the wettability of a peat dyke. According to Vieffect Int. BV VIMI-X is a product on the basis of natural organic microbes and organic acids and can be used as a natural surfactant to enhance water penetration. To study the effects of VIMI-X an experimental field along the slope of a peat dyke was divided into two plots. On the first plot VIMI-X was regularly applicated and the other untreated plot was used for comparison.

Figure 1. Application of VIMI-X at the experimental field.

2. Methods

2.1 The Experimental Field

The experimental field is located at "de Middelburgse kade" in Waddinxveen, situated north of Rotterdam. This dyke is an inland dam which mainly consists of peat. A part of the dyke was used for the field trial. A plot of 6,4 m by 20 m was allocated to be treated with VIMI-X and a same adjacent plot was used for comparison.

During the experimental period from 14 June till 29 September, 2004 the precipitation was partly recorded on location. For the missing periods the rain data recorded by weather station Boskoop were used. The transpiration data were used from the KNMI weather station in Rotterdam.

Figure 2. Taking samples from the experimental field.

2.2 Treatments and Soil Sampling

On 14 June, 19 July and 30 August, 2004 VIMI-X was applied to a part of the experimental field (6.4 m by 20 m) at a rate of …… ml/m^2 and with a volume solution of ….. ml/m^2 with a Mesto Pico backpack-sprayer (Fig. 1). An adjacent same area was not treated and was used for comparison.

Figure 3. Soil samples at depths of more than 30 cm were taken using a special soil sampler.

On 14 June soil samples were taken at five depths and at the subsequent three sampling dates four depths were sampled, in the untreated as well as in the plot treated with VIMI-X. The samples were taken in vertical transects on 14 June, 19 July, 30 August and 29 September, 2004 to study the water content and the persistence of the actual and potential water repellency The soil was sampled at depths of 2-7, 25-30, 50-55, 75-80 and

100-105 cm (only first time), using steel cylinders with a diameter of 5 cm. At each depth 5 samples were taken over a distance of 80 cm with intervals of 20 cm (Fig. 2). The cylinders were pressed vertically into the soil, emptied into plastic bags and used again. For depths beneath 30 cm the samples were taken with a special auger (Fig. 3). The plastic bags were tightly sealed to minimize evaporation from the soil. The field-moist soil in the plastic bags was weighed and the persistence of actual water repellency was measured. All samples had been oven-dried at 105^{0}C and weighed to calculate the soil water content and after a couple of days of acclimatisation on the lab the persistence of potential water repellency was measured.

2.3 Water Drop Penetration Time (WDPT) Test

The persistence or stability of water repellency of the soil samples was examined using the water drop penetration time (WDPT) test. Three drops of distilled water from a standard medicine dropper were placed on the smoothed surface of a soil sample, and the time that elapses before the drops were absorbed was determined. We measured the water repellency of the soil samples under controlled conditions at a constant temperature of 20^{0}C and a relative air humidity of 50%. In general, a soil is considered to be water repellent if the WDPT exceeds 5 s (Dekker, 1998, Oostindie et al., 2002). We applied an index allowing a quantitative definition of the persistence of soil water repellency as described by Dekker and Jungerius (1990). In the present study five classes of repellency were distinguished, based upon the time needed for the water drops to penetrate into the soil:

class 0, wettable, non-water repellent (infiltration within 5 s);
class 1, slightly water repellent (5 to 60 s);
class 2, strongly water repellent (60 to 600 s);
class 3, severely water repellent (600 s to 1 h);
class 4, extremely water repellent (more than 1 h)

We measured the water repellency of the field-moist samples and of the samples after drying in an oven, the so-called “potential soil water repellency” (Dekker and Ritsema, 1994). Measurements of the actual water repellency were performed immediately after assessment of the wet weights of the samples. The persistence of potential water repellency of the samples was measured after drying at 105^{0}C. The WDPT tests were deferred for at least 2 days to obtain samples in equilibrium with the ambient air humidity (Doerr et al., 2002).

Table 1. Amount of precipitation, transpiration and precipitation surplus between the subsequent sampling dates at the peat dyke in Waddinxveen.

Period	Precipitation (mm)	Transpiration (mm)	Precipitation surplus (mm)
14 June - 19 July	149.7	103.6	46.1
19 July - 30 August	236.1	124.7	111.4
30 August - 29 September	89.6	60.4	29.2
Total	475.4	288.7	186.7

Table 2. Frequencies of the persistence of actual water repellency of soil samples taken at different depths on four dates.

	Untreated						VIMI-X					
		WDPT class						WDPT class				
Date	Depth (cm)	0	1	2	3	4	Depth (cm)	0	1	2	3	4
14 June	2-7	1		4			2-7		2	3		
	25-30	2		3			25-30			1	4	
	50-55	5					50-55	1	3	1		
	75-80	5					75-80	5				
	100-105	5					100-105	5				
19 July	2-7	5					2-7	5				
	25-30	5					25-30	4				
	50-55	5					50-55	4				
	75-80	5					75-80	5				
30 August	2-7	5					2-7	5				
	25-30	5					25-30	4				
	50-55	5					50-55	5				
	75-80	5					75-80	5				
29 September	2-7	5					2-7	5				
	25-30	5					25-30	5				
	50-55	5					50-55	5				
	75-80	5					75-80	5				

3. Results

3.1 Dry Bulk Density and Organic Matter Content

The dyke is covered with either a thin clay, clayey sand or loam layer of around 7-25 cm thickness. Beneath this depth the profile mainly consists of peat and clayey peat. The dry bulk density in the top layer varies between 0.87 to 1.36 $g.cm^{-3}$. The calculated organic matter content is strongly related to the bulk density and varied in this layer between 5.0 and 15.1%. The peat samples in the deeper layers of the profile have a much lower bulk density. For these samples with dry bulk densities ranging from 0.93 to 0.21 $g.cm^{-3}$, a decreasing bulk density with increasing depth was found (see Annex 1-4 and Figures 4-6). However the organic matter content increases with depth, and ranges from around 18% at depths of 25-30 cm to 25-40% at depths of 75-80 cm.

3.2 Weather data

During the experimental period from 14 June till 29 September a total rainfall of 475.5 mm was recorded. During this period the transpiration amounted to 288.7 mm and the precipitation surplus was aggregated to 186.7 mm (Table 1). Very eye-catching is the second period with a precipitation surplus of 111.4 mm. A relatively dry spring period was followed up by a relatively wet summer.

3.3 Actual Water Repellency

Table 2 shows frequencies of the persistence of water repellency of the samples during the four sampling dates. After a relatively dry spring time water repellency started to develop up to a depth of 30 cm in the untreated plot. Four samples in the top layer (2-7 cm) and three samples in the subsequent layer (25-30 cm) were found to be strongly water repellent with a penetration time of 60 to 600 seconds (class 2). The plot, which was to be treated with VIMI-X, showed an even stronger water repellent behaviour. At the start of the experiment water repellency was measured to a depth of 55 cm. Up to this depth only one sample was wettable (WDPT class 0), 5 samples were slightly water repellent (class 1), also 5 samples were strongly water repellent (class 2) and even four samples from the second layer were severely water repellent (class 3). It can be concluded that the plot to be treated, on the one hand showed a more persistent water repellency and on the other hand water repellency was found at greater depths in comparison with the untreated plot. After the first application the profile of both plots became wettable due to a surplus of precipitation and both plots remained wettable till the end of the experiment.

3.4 Potential Water Repellency

Frequencies of the persistence of potential soil water repellency are shown in table 3. Most of the samples from the top layer were wettable after drying at 105^0C, except some clayey sand samples on 14 June from the untreated plot and one loam sample on 19 July from the treated plot. However, all peat samples were water repellent after drying at 105^0C. The degree of this water repelency increased with depth. In general the samples

Table 3. Frequencies of the persistence of potential water repellency of soil samples taken at different depths on four dates.

	Untreated						VIMI-X					
		WDPT class						WDPT class				
Date	Depth (cm)	0	1	2	3	4	Depth (cm)	0	1	2	3	4
14 June	2-7	2	2	1			2-7	5				
	25-30	3	2				25-30			5		
	50-55	2	3				50-55			3	2	
	75-80			5			75-80			4	1	
	100-105				3	2	100-105			2	1	2
19 July	2-7	5					2-7	4	1			
	25-30	1		3	1		25-30			4		
	50-55			1	4		50-55				1	3
	75-80			1	4		75-80			1	3	1
30 August	2-7	5					2-7	5				
	25-30		5				25-30	2	2			
	50-55		2	1		2	50-55			5		
	75-80		3	2			75-80			4	1	
29 September	2-7	5					2-7	5				
	25-30			5			25-30			3		2
	50-55			5			50-55				3	2
	75-80			2	3		75-80				3	2

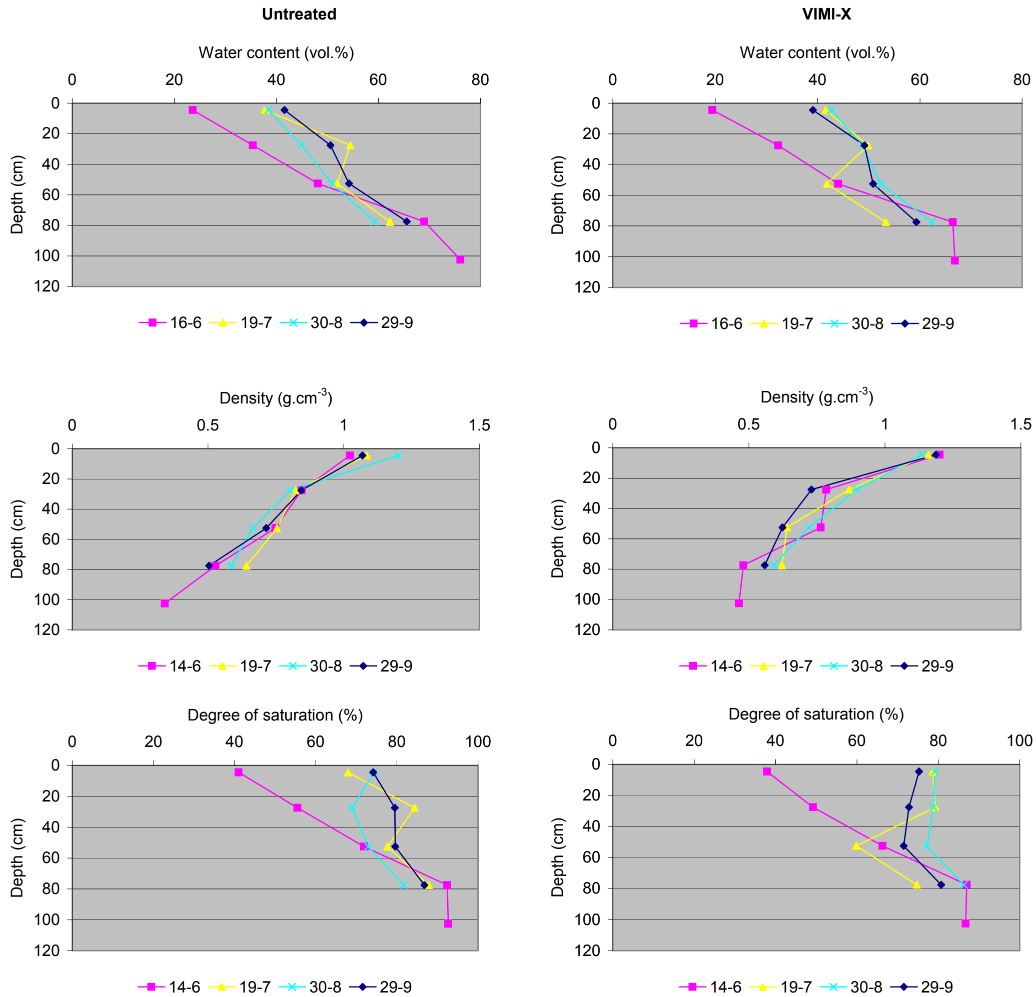

Figure 4. Water content, dry bulk density and degree of saturation on four dates in the untreated plot (left-hand side) and in the VIMI-X treated plot (right-hand side).

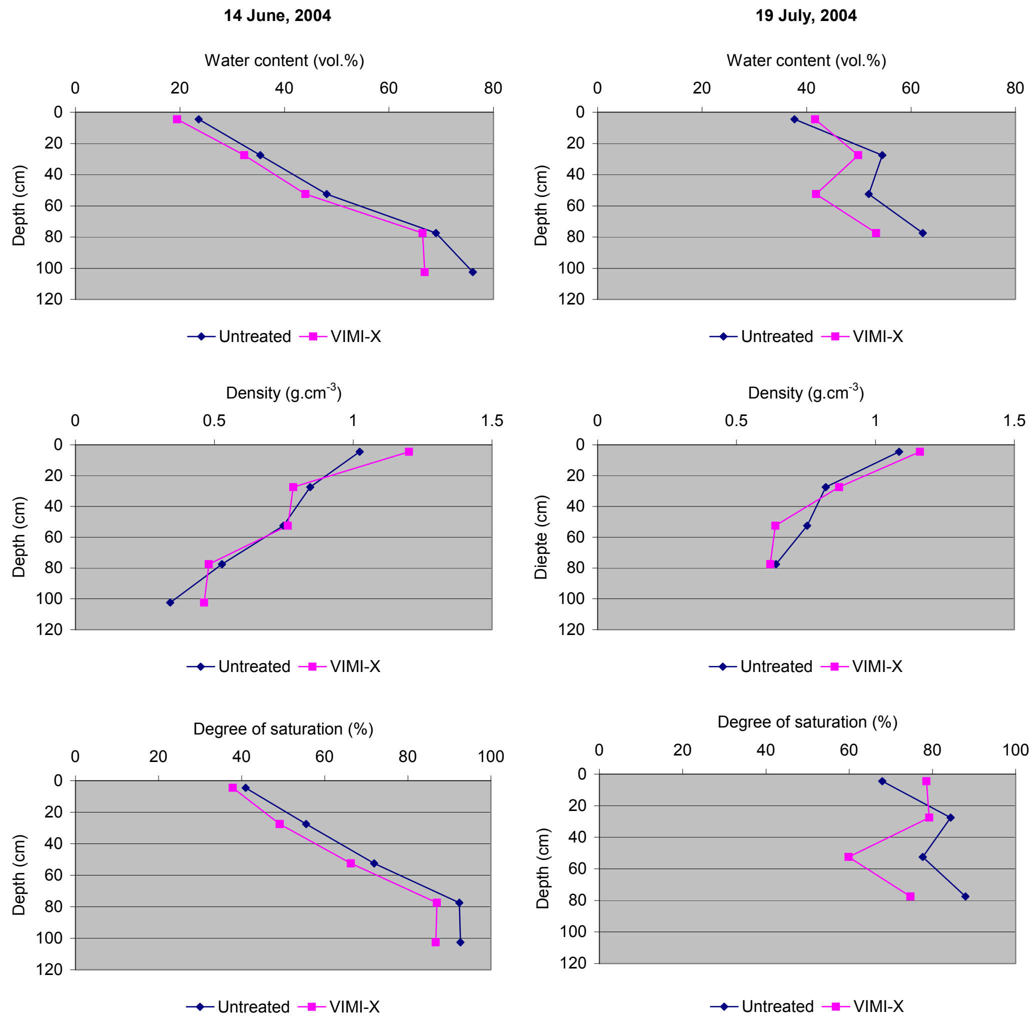

Figure 5. Water content, dry bulk density and degree of saturation for the untreated and treated plot on 14 June, 2004 (left-hand side) and on 19 July, 2004 (right-hand side).

below 30 cm depth from the treated plot showed a higher degree of potential water repellency.

3.5 Water Content and Degree of Saturation

Moisture content, dry bulk density and degree of saturation have been depicted in Figure 4. At the start of the experiment the water content in the untreated plot as well as in the treated plot was relatively low. As a result of almost 150 mm rainfall, which was more than 46 mm above the transpiration, especially the upper part of the soil profile became wetter. In the period from 19 july to 30 August the top layer became wetter, but below this layer the profile of the untreated plot became drier. This is surprising in the light of the 111 mm of precipitation surplus. In contrast with the untreated plot, the profile beneath 30 cm depth of the plot which was treated with VIMI-X became wetter during this period. During the last period the water content of the untreated plot increased while the treated plot remained at the same level. However, the degree of saturation of this treated plot was slightly lower due to lower bulk densities. Interesting was the analysis of the change of the amount of water in the profile for the two plots at the different sampling dates. It was assumed that: 1) the measured water content at 2-7 cm depth was a good estimation for the layer from 0-16 cm depth, 2) the measured water content at 25-30 cm depth was an estimation for the layer from 16 to 40 cm depth etc. According to this assumptions the amount of water stored in the first 90 cm of the profile during the first sampling date was 415 mm in the untreated and 385 mm in the treated plot. After the second sampling date on 19 July these water amounts increased to 476 mm in the untreated and 424 mm in the treated plot. This means an increase of 61 mm in the untreated and 39 mm in the treated plot. The precipitation surplus was 46 mm, thus the increase at the untreated plot was higher than the precipitation surplus, which means that there might be lateral waterflow towards this plot. On 30 August there was a decrease of 32 mm in the untreated plot, despite an precipitation surplus of almost 125 mm. In the treated plot there was an increase of 48 mm of water. On the last sampling date 29 September, there was a slight decrease of water amount for the treated plot of 16 mm, while the untreated plot increased with 42 mm of water.

In Figures 5 and 6 comparisons have been made for each sampling date between the untreated plot and the plot treated with VIMI-X with respect to the water content, bulk density and degree of saturation. At the initial state on 14 June the untreated plot started with a bit wetter profile. On 19 July the top layer of the treated plot became wetter than the untreated plot. Worthy of note is that each individual sample of the treated plot is wetter than the wettest one from the untreated plot.The differences in the rest of the profile are more clear than at the start of the experiment. On 31 August the whole profile of the treated plot was slightly wetter, but the difference in the degree of saturation between the two plots was eye-catching. On 29 September, the last sampling date, the water content of the treated plot remained on the same level but the degree of saturation dropped a few percentages. However, the untreated plot became wetter during this period and finished with an average degree of saturation of around 80%.

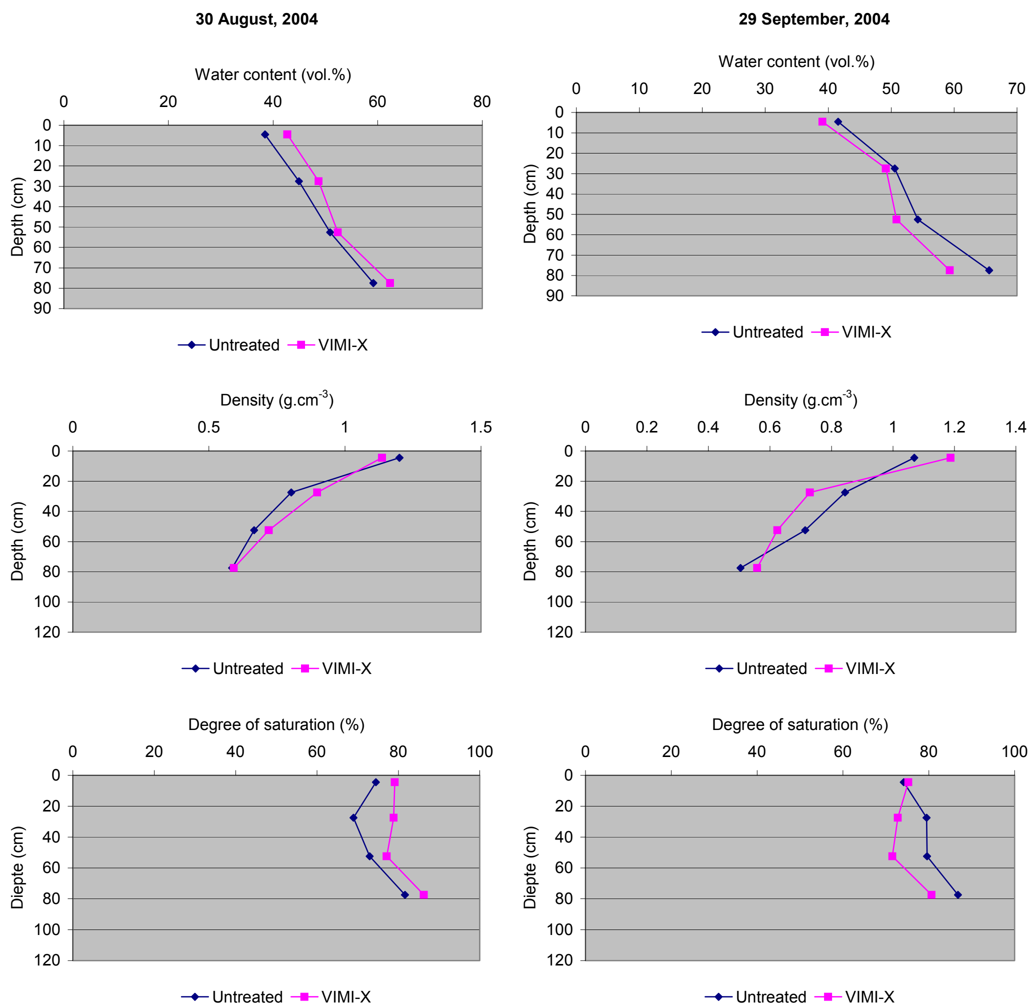

Figure 6. Water content, dry bulk density and degree of saturation for the untreated and the treated plot on 30 August, 2004 (left-hand side) and 29 September, 2004 (right-hand side).

4 Conclusions

Conclusions from this experiment concerning the effects of VIMI-X on the wettability of a peat dyke are:

- Although the experiment started after a promising dry spring, the summer was unfortunately relative wet,
- Actual water repellency was detected in both plots at the start of the experiment due to the dry spring,
- Natural conditions (too wet) during the experimental period were not ideal for testing the effects of VIMI-X, and due to the excessive precipitation the whole profile of both plots recovered from being water repellent, which already occurred after the first sampling date.
- All peat samples were potentially water repellent and the degree of repellency increased with depth.
- The increase in degree of saturation was tremendous in the top layer from the treated plot on the second sampling date.
- After the third sampling the whole profile of the treated plot was wetter than the profile of the untreated plot, however, on the last sampling date the opposite was found, but with exception of the top layer.

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Annex 1. Sampling results from June 14, 2004.

Date: 14-Jun-04

Untreated

Depth (cm)	Density (g.cm^{-3})	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)	Soil material
2-7	1.26	22.0	6.3	49.8	27.8	44.1	cl. sand
2-7	0.87	22.0	15.1	62.9	40.8	35.0	cl. sand
2-7	0.92	28.0	13.6	61.3	33.3	45.7	cl. sand
2-7	1.05	23.3	10.0	56.8	33.4	41.1	cl. sand
2-7	1.01	22.7	11.1	58.3	35.6	38.9	cl. sand
25-30	0.84	33.7	16.3	63.9	30.2	52.7	p. sand
25-30	0.88	36.7	14.8	62.6	25.9	58.7	p. sand
25-30	0.78	36.4	18.9	66.1	29.7	55.0	s. peat
25-30	0.87	35.1	15.4	63.1	28.0	55.7	s. peat
25-30	0.86	35.1	15.6	63.2	28.1	55.5	s. peat
50-55	0.69	46.9	22.9	69.0	22.1	67.9	s. peat
50-55	0.70	43.9	22.3	68.5	24.6	64.0	s. peat
50-55	0.82	53.1	17.3	64.8	11.7	82.0	s. peat
50-55	0.77	47.6	19.1	66.2	18.7	71.8	s. peat
50-55	0.76	49.1	19.7	66.7	17.6	73.6	s. peat
75-80	0.53	69.4	33.0	74.5	5.1	93.2	peat
75-80	0.49	71.4	36.2	75.9	4.6	94.0	peat
75-80	0.54	68.7	32.1	74.1	5.3	92.8	peat
75-80	0.54	69.5	32.3	74.1	4.6	93.7	peat
75-80	0.53	65.9	33.6	74.7	8.8	88.2	peat
100-105	0.48	71.6	37.6	76.5	5.0	93.5	peat
100-105	0.38	75.5	46.6	80.1	4.6	94.2	peat
100-105	0.41	69.7	44.2	79.2	9.5	88.0	peat
100-105	0.21	83.7	69.7	87.8	4.2	95.3	peat
100-105	0.23	79.9	65.5	86.5	6.7	92.3	peat

cl = clayey
s = sandy
p = peaty

VIMI-X

Depth (cm)	Density (g.cm^{-3})	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)	Soil material
2-7	1.14	18.1	8.31	54.0	36.0	33.4	clay
2-7	1.30	22.0	5.65	48.3	26.3	45.6	clay
2-7	1.30	20.2	5.70	48.4	28.2	41.7	clay
2-7	1.13	17.3	8.41	54.2	36.9	31.9	clay
2-7	1.14	19.8	8.26	54.0	34.2	36.7	clay
25-30	0.78	29.3	18.54	65.8	36.5	44.6	s. peat
25-30	0.80	33.4	18.02	65.4	32.0	51.1	s. peat
25-30	0.79	36.1	18.13	65.5	29.4	55.1	s. peat
25-30	0.71	29.3	21.91	68.3	39.0	42.9	s. peat
25-30	0.83	33.5	16.67	64.3	30.7	52.2	s. peat
50-55	0.75	43.4	19.98	66.9	23.5	64.9	s. peat
50-55	0.77	46.3	18.96	66.1	19.8	70.0	s. peat
50-55	0.79	46.2	18.16	65.5	19.3	70.5	peat
50-55	0.78	49.1	18.81	66.0	16.9	74.4	s. peat
50-55	0.72	35.1	21.38	67.9	32.8	51.7	s. peat
75-80	0.46	60.2	38.77	77.0	16.8	78.2	s. peat
75-80	0.51	66.1	35.00	75.4	9.3	87.7	peat
75-80	0.47	67.1	38.09	76.8	9.7	87.4	peat
75-80	0.42	69.4	42.75	78.7	9.2	88.2	peat
75-80	0.54	69.4	32.49	74.2	4.8	93.5	peat
100-105	0.58	64.3	29.52	72.7	8.4	88.4	peat
100-105	0.54	62.2	32.80	74.4	12.2	83.6	peat
100-105	0.41	69.5	43.83	79.1	9.6	87.9	peat
100-105	0.44	69.1	40.49	77.8	8.7	88.9	peat
100-105	0.35	69.2	50.62	81.6	12.4	84.8	peat

cl = clayey
s = sandy
p = peaty

Annex 2. Sampling results from July 19, 2004.

Date: 19-Jul-04

Untreated

Depth (cm)	Density (g.cm^{-3})	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)	Soil material
2-7	1.26	37.1	6.20	49.6	12.6	74.7	cl. sand
2-7	1.15	37.2	7.95	53.4	16.2	69.7	cl. sand
2-7	0.94	37.5	13.13	60.8	23.3	61.6	cl. sand
2-7	1.01	38.0	11.02	58.2	20.2	65.3	cl. sand
2-7	1.06	38.8	9.86	56.6	17.8	68.6	cl. sand
25-30	0.90	53.5	14.24	62.0	8.5	86.3	cl. sand
25-30	0.79	56.5	18.50	65.8	9.3	85.9	cl. peat
25-30	0.84	55.4	16.30	63.9	8.6	86.6	cl. peat
25-30	0.79	54.6	18.15	65.5	10.9	83.4	cl. peat
25-30	0.79	52.4	18.49	65.8	13.4	79.6	cl. peat
50-55	0.74	51.7	20.49	67.3	15.6	76.8	s. peat
50-55	0.75	54.0	20.01	66.9	12.9	80.7	peat
50-55	0.72	49.5	21.55	68.0	18.6	72.7	peat
50-55	0.80	55.6	18.02	65.4	9.8	85.0	peat
50-55	0.76	48.8	19.56	66.6	17.8	73.3	peat
75-80	0.62	63.5	27.12	71.5	8.0	88.8	peat
75-80	0.57	65.3	30.01	73.0	7.7	89.5	peat
75-80	0.61	65.9	27.49	71.7	5.8	91.9	peat
75-80	0.79	51.0	18.17	65.5	14.6	77.8	peat
75-80	0.61	65.7	27.63	71.7	6.0	91.6	peat

cl = clayey
s = sandy

VIMI-X

Depth (cm)	Density (g.cm^{-3})	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)	Soil material
2-7	1.29	41.8	5.77	48.6	6.7	86.1	clay
2-7	0.96	45.3	12.28	59.8	14.5	75.7	clay
2-7	1.14	39.8	8.29	54.0	14.2	73.8	loam
2-7	1.26	40.4	6.27	49.8	9.4	81.1	loam
2-7	1.15	40.7	8.09	53.6	12.9	76.0	loam
25-30	0.78	50.3	18.62	65.9	15.6	76.3	cl. peat
25-30	0.93	47.9	13.19	60.8	13.0	78.7	cl. peat
25-30	0.89	48.2	14.46	62.2	14.0	77.5	cl. peat
25-30							
25-30	0.87	53.3	15.39	63.1	9.8	84.5	peat
50-55							
50-55	0.62	37.2	27.07	71.4	34.2	52.1	peat
50-55	0.68	48.1	23.67	69.4	21.3	69.3	peat
50-55	0.77	53.0	19.24	66.4	13.3	79.9	peat
50-55	0.49	28.9	36.12	75.9	47.0	38.1	peat
75-80	0.66	46.2	24.67	70.0	23.9	65.9	peat
75-80	0.68	54.1	23.63	69.4	15.3	78.0	peat
75-80	0.54	53.1	32.31	74.1	21.0	71.6	peat
75-80	0.58	56.2	29.38	72.7	16.4	77.4	peat
75-80	0.64	57.0	25.66	70.6	13.6	80.7	peat

cl = clayey
s = sandy

Annex 3. Sampling results from August 30, 2004.

Date: 30-Aug-04

Untreated

Depth (cm)	Density ($g.cm^3$)	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)	Soil material
2-7	1.15	42.3	7.95	53.4	11.1	79.2	loam
2-7	1.20	35.9	7.20	51.9	16.0	69.1	loam
2-7	1.33	37.4	5.37	47.5	10.1	78.7	loam
2-7	1.07	39.2	9.74	56.4	17.2	69.4	loam
2-7	1.26	37.8	6.24	49.8	12.0	75.9	loam
25-30	0.77	45.4	19.07	66.2	20.8	68.6	loam
25-30	0.79	46.0	18.14	65.5	19.5	70.2	loam
25-30	0.73	43.8	20.88	67.6	23.7	64.9	loam
25-30	0.82	45.0	17.00	64.5	19.6	69.6	loam
25-30	0.89	44.5	14.60	62.3	17.8	71.4	loam
50-55	0.61	47.7	27.67	71.8	24.1	66.4	cl. peat
50-55	0.65	53.1	25.42	70.5	17.4	75.3	cl. peat
50-55	0.67	53.3	24.37	69.9	16.6	76.3	cl. peat
50-55	0.69	49.2	22.82	68.9	19.6	71.5	cl. peat
50-55	0.71	51.3	21.80	68.2	16.9	75.1	cl. peat
75-80	0.58	59.5	29.46	72.7	13.2	81.9	peat
75-80	0.63	65.4	26.61	71.2	5.8	91.8	peat
75-80	0.60	63.7	28.53	72.2	8.5	88.2	peat
75-80	0.57	56.1	30.52	73.3	17.1	76.6	peat
75-80	0.55	51.2	31.44	73.7	22.5	69.4	peat

cl = clayey

VMI-X

Depth (cm)	Density ($g.cm^3$)	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)	Soil material
2-7	1.18	38.2	7.56	52.6	14.4	72.6	loam
2-7	1.17	45.1	7.67	52.8	7.8	85.3	loam
2-7	1.12	42.2	8.60	54.5	12.3	77.4	loam
2-7	1.07	47.8	9.74	56.4	8.6	84.7	loam
2-7	1.15	40.4	8.02	53.5	13.1	75.6	loam
25-30	0.94	43.7	12.90	60.5	16.8	72.3	loam
25-30							
25-30	0.89	49.8	14.41	62.1	12.3	80.2	loam
25-30	1.00	53.2	11.34	58.6	5.4	90.8	sand + loam
25-30	0.76	48.2	19.85	66.8	18.7	72.1	clay
50-55	0.69	50.7	23.01	69.0	18.3	73.5	cl. peat
50-55	0.71	49.3	21.89	68.3	19.0	72.2	cl. peat
50-55	0.68	52.1	23.37	69.2	17.1	75.2	cl. peat
50-55	0.77	52.9	19.17	66.3	13.4	79.8	cl. peat
50-55	0.74	57.1	20.40	67.2	10.1	84.9	cl. peat
75-80	0.66	67.8	24.53	69.9	2.1	96.9	cl. peat
75-80	0.58	59.4	29.90	72.9	13.6	81.4	cl. peat
75-80	0.56	57.9	31.15	73.6	15.7	78.7	cl. peat
75-80	0.60	62.5	28.12	72.0	9.5	86.8	cl. peat
75-80	0.56	64.4	31.25	73.6	9.3	87.4	cl. peat

cl = clayey

Annex 4. Sampling results from September 29, 2004.

Date: 29-Sep-04

Untreated

Depth (cm)	Density ($g.cm^{-3}$)	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)
2-7	1.07	40.1	9.66	56.3	16.2	71.2
2-7	0.99	34.8	11.55	58.9	24.1	59.1
2-7	1.12	46.4	8.66	54.6	8.2	84.9
2-7	1.05	41.7	10.19	57.0	15.3	73.1
2-7	1.12	44.9	8.56	54.5	9.6	82.4
25-30	0.73	53.5	20.79	67.5	14.0	79.2
25-30	0.80	50.6	17.71	65.1	14.6	77.6
25-30	0.89	51.3	14.68	62.4	11.1	82.3
25-30	0.98	53.5	11.76	59.1	5.7	90.4
25-30	0.81	44.0	17.46	64.9	20.9	67.8
50-55	0.67	54.7	23.94	69.6	14.9	78.5
50-55	0.68	53.4	23.41	69.3	15.8	77.2
50-55	0.75	55.6	19.93	66.9	11.3	83.2
50-55	0.74	55.4	20.46	67.3	11.9	82.4
50-55	0.72	52.1	21.40	67.9	15.8	76.7
75-80	0.58	57.1	29.97	73.0	15.8	78.3
75-80	0.47	72.3	37.95	76.7	4.4	94.3
75-80	0.43	59.9	41.74	78.3	18.3	76.6
75-80	0.53	65.2	33.08	74.5	9.3	87.6
75-80	0.51	73.2	34.68	75.3	2.1	97.2

VIMI-X

Depth (cm)	Density ($g.cm^{-3}$)	Water content (vol.%)	Organic matter content (%)	Volume of pores (%)	Volume of air (%)	Degree of saturation (%)
2-7	1.06	37.4	9.91	56.6	19.3	65.9
2-7	1.38	38.0	5.01	46.4	8.4	81.8
2-7	1.14	38.2	8.27	54.0	15.7	70.9
2-7	1.23	44.0	6.76	51.0	7.0	86.3
2-7	1.16	37.9	7.84	53.2	15.3	71.2
25-30	0.75	53.0	19.88	66.8	13.8	79.3
25-30	0.68	44.3	23.48	69.3	25.0	63.9
25-30	0.69	44.5	23.15	69.1	24.6	64.3
25-30	0.74	49.4	20.64	67.4	18.0	73.3
25-30	0.79	54.7	18.46	65.8	11.1	83.1
50-55	0.64	54.0	25.76	70.7	16.7	76.4
50-55	0.66	55.0	24.54	70.0	14.9	78.6
50-55	0.55	44.3	31.41	73.7	29.4	60.1
50-55	0.58	47.0	29.40	72.7	25.6	64.7
50-55	0.68	54.0	23.71	69.4	15.5	77.7
75-80	0.51	60.4	34.52	75.2	14.8	80.3
75-80	0.48	59.2	37.02	76.3	17.1	77.5
75-80	0.61	58.4	27.42	71.6	13.3	81.5
75-80	0.58	59.2	29.84	72.9	13.7	81.2
75-80	0.61	59.6	27.98	71.9	12.4	82.8