

README

***** Quantitative visual soil observations for visual soil evaluation on dairy farms *****

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*** General introduction and terms of use ***

This dataset contains data belonging to the manuscript 'Visual soil evaluation: reproducibility and correlation with standard measurements', and data that is not published before.

Data is being made public as supplementary data for the manuscript (Van Leeuwen et al., 2018), and to be used by others for further research.

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*** Purpose of the data collection ***

The data were mainly collected to evaluate whether quantitative visual observations (as part of Visual Soil Evaluation) correlated with standard field or laboratory measurements (Van Leeuwen et al., 2018). Other data were collected for a similar study, but in the end they were not used in a manuscript (Van Leeuwen et al., in review).

*** Methodological information ***

Quantitative visual observations were collected for two studies on dairy farms in the Netherlands. Data were collected following the same methodology (Van Leeuwen et al., 2018) based on Visual Soil Assessment of Shepherd (2009), and can be categorized into three sets:

1. Data belonging to a manuscript (Van Leeuwen et al., 2018). Quantitative visual observations were collected at 26 dairy farms in the North of the Netherlands, on one site per farm. Sites were located on sand, peat, and clay soils. Sampling period: 22 September 2014 - 18 October 2014. (In dataset: column Study = 'NFW' and Field = '0'. 'NFW' stands for the Dutch region 'North Friesian Woodlands')
2. Data that were intended to be used in the same study as in 1 (Van Leeuwen et al., 2018), but were redundant. Quantitative visual observations were collected at the same 26 dairy farms in the North of the Netherlands, on two additional sites per farm. Sites were located on sand, peat, and clay soils. Sampling period: 22

September 2014 - 18 October 2014. (In dataset: column Study = 'NFW' and Field = '1' or '2'.)

- Data that were intended to be used in Van Leeuwen et al. (in review), but were redundant for that study. Quantitative visual observations were collected at 5 dairy farms in the Netherlands on five sites per farm, additionally to the five sampled sites per farm in Van Leeuwen et al. (in review). Sites were located on sand and clay soils. Sampling period: 12 September 2016 - 5 October 2016. (In dataset: column Study = 'K_K'.)

*** Description of the data in this data set ***

The data is made available in two formats; an Excel file and .csv file (both containing the same data).

Value '-999' means that data could not be made public (i.e. when no permission was given by the farmer, no X and Y location could be given), or that data were not collected.

Column headers	Measurement unit	Explanation
Study	n/a	NFW: Visual observations collected at dairy farms in the North Friesian Woodlands, North of the Netherlands, in 2014. Part of the data (all data that have Study 'NFW' and Field value '0') are used and described in Van Leeuwen et al. (2018). K_K: Visual observations collected at five dairy farms that were part of the ongoing project of 'Cows and Opportunities' (in Dutch: Koeien&Kansen).
Year	n/a	Year of data collection. 2014 (for NFW data) and 2016 (for K_K data). In both years, data were collected in September and October.
FarmID	n/a	Identifier of the dairy farms. For farms in the North Friesian Woodlands (NFW): 1 to 26. For farms of the project 'Cows ad Opportunities' (K_K; see Van Leeuwen et al., 2019 for study area, or Van Leeuwen et al., in review): 'SHo': Sand; Homogeneous in terms of the number of different soil series occurring within the farm. (In Van Leeuwen et al., in review: 'Farm 1'.) 'SHe1': Sand; Heterogeneous in terms of the number of different soil series occurring within the farm. (In Van Leeuwen et al., in review: 'Farm 2'.) 'SHe2': Sand; Heterogeneous in terms of the number of different soil series occurring within the farm. (In Van Leeuwen et al., in review: 'Farm 3'.) 'CHo': Clay; Homogeneous in terms of the number of different soil series occurring within the farm. (In Van Leeuwen et al., in review: 'Farm 4'.) 'Che': Clay; Heterogeneous in terms of the number of different soil series occurring within the farm. (In Van

		Leeuwen et al., in review: 'Farm 5'.)
Field	n/a	Identifier of sampled locations. NFW data: Field = 0: these data were used in Van Leeuwen et al. (2018). Next to quantitative visual observations, standard field and laboratory measurements were performed. Field = 1 or 2: these data were not published before. K_K data: Numbers of fields.
X	meter	X coordinate of the sampled location (coordinate system: RD_new).
Y	meter	Y coordinate of the sampled location (coordinate system: RD_new).
Crop	n/a	Grass or maize, assessed during the fieldwork period.
Texture	n/a	Soil texture class. General classification based on visual and tactical observation in the top 20 cm of the soil. The classes 'sand', 'peat', or 'clay' were used in Van Leeuwen et al. (2018).
length	cm	Length (cm) of one of the sides of the excavated topsoil block. The topsoil block was used for visual soil quality observations.
width	cm	Width (cm) of one of the sides of the excavated topsoil block. The topsoil block was used for visual soil quality observations.
height	cm	Height (cm) of one of the sides of the excavated topsoil block. The topsoil block was used for visual soil quality observations.
Grass	%	Grass cover on surface: % covered with grass in 1 m ² around the place to be sampled – before extracting a soil block.
Biopores	Count per 20x20 cm	Number of biopores (often earthworm burrows) >2mm, on a surface area of 20x20 cm, approximately at 20 cm depth (bottom of soil block).
Biopores_corr	Count per 20x20 cm	Number of biopores (often earthworm burrows) >2mm, on a surface area of 20x20 cm, approximately at 20 cm depth (bottom of soil block). Number was corrected when soil surface was not exactly 20x20 cm, using the actual size of the block length and width (see column 'length' and 'width').
Roots	Count per 10x10 cm	Number of roots on a surface area of 10x10 cm, at 20 cm depth (bottom of soil block).
Col_Hue	n/a	Munsell soil colour Hue at 20 cm depth (bottom of the soil block), of moist soil. Hue refers to the used soil colour card of the Munsell soil colour charts.
Col_Val	n/a	Munsell soil colour Value at 20 cm depth (bottom of the soil block), of moist soil. 'Value' indicates the darkness of the soil and is assessed with Munsell soil colour charts.

Col_chr	n/a	Munsell soil colour Chroma at 20 cm depth (bottom of the soil block), of moist soil. 'Chroma' indicates the colour of the soil and is assessed with Munsell soil colour charts.
Gley	%	Percentage of gley mottles (spots of iron oxides) covering the surface, approximately at 20 cm depth (bottom of soil block).
Struc_sc	Score	Overall shape of soil structure in the 10-20 cm layer. Score 2 = good condition: granular shape. 1 = moderate condition: subangular shape. 0 = poor condition: angular shape. See also Shepherd (2009). The 10-20 cm layer of the soil block is gently crumbled by hand following natural cracks, before soil structure is assessed.
Struc_percent	%	The percentage (%) of largest soil structural elements. Obtained from the crumbled 10-20 cm layer of the soil block. Soil structural elements are ordered based on their size, on a plastic bag, before assessment.
Struc_sizeL	cm	The mean size (cm) of the largest soil structural elements in the 10-20 cm layer. The 10-20 cm layer of the soil block is gently crumbled by hand following natural cracks, and structural elements are ordered based on their size before soil structure is assessed.
Struc_shpL	Score	Overall shape of the largest soil structural elements in the 10-20 cm layer. Score 2 = good condition: granular shape. 1 = moderate condition: subangular shape. 0 = poor condition: angular shape. See also Shepherd (2009). The 10-20 cm layer of the soil block is gently crumbled by hand following natural cracks, and structural elements are ordered based on their size before soil structure is assessed.
Struc_sizeS	cm	The mean size (cm) of the smallest soil structural elements in the 10-20 cm layer. The 10-20 cm layer of the soil block is gently crumbled by hand following natural cracks, and structural elements are ordered based on their size before soil structure is assessed.
Struc_shpS	Score	Overall shape of the smallest soil structural elements in the 10-20 cm layer. Score 2 = good condition: granular shape. 1 = moderate condition: subangular shape. 0 = poor condition: angular shape. See also Shepherd (2009). The 10-20 cm layer of the soil block is gently crumbled by hand following natural cracks, and structural elements are ordered based on their size before soil structure is assessed.
Worms	Count in 20x20x20 cm	Total number of earthworms in soil block of 20x20x20 cm.
Worms_corr	Count in 20x20x20 cm	Total number of earthworms in soil block of 20x20x20 cm, corrected for volume when soil block volume was deviating.

Epigeic	Count in 20x20x20 cm	Number of epigeic earthworms in soil block of 20x20x20 cm.
Endogeic	Count in 20x20x20 cm	Number of endogeic earthworms in soil block of 20x20x20 cm.
Anecic	Count in 20x20x20 cm	Number of anecic earthworms in soil block of 20x20x20 cm.
Nnworms	Count in 20x20x20 cm	Number of earthworms that could not be classified as epigeic, endogeic or anecic in soil block of 20x20x20 cm.
Comp_d	cm below surface	Soil compaction depth, cm below surface. See also Shepherd (2009).
Comp_sc	Score	Soil compaction score/degree: 2: no compaction, 1: moderate compaction, 0: strong compaction. See also Shepherd (2009).
Root_d	cm below surface	Root depth of approximately 85% of all roots, which is visible as the depth of the bulk of the roots. Assessed on one of the sides of the soil pit (which was approximately 50 cm deep).
Ahor	cm below surface	Depth of topsoil (A) horizon where organic matter is accumulated.
TextClass	n/a	Soil texture class observation in the topsoil horizon, according to FAO (2006): LS: Loamy sand SL: Sandy loam SCL: Sandy clay loam CL: Clay loam SC: Sandy clay SiC: Silty clay C: Clay HC: Heavy clay VFS: Very fine sand FS: Fine sand CS: Coarse sand US: Sand, unsorted LVFS: Loamy very fine sand Organic: peaty material .._o: soil very rich in organic material (peaty).
Soil	n/a	Soil series (soil mapping unit) on the 1:50.000 soil map of the Netherlands (Alterra, 2006).

*** Acknowledgements ***

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