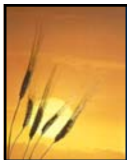

PROXIMAL SOIL SENSING IN THE FRAMEWORK OF ISOIL PROJECT

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The Soil Copany, The Netherlands
Medusa Explorations, The Netherlands

Experimental field

16.3 ha, Dystric Cambisol, 440 to 460 m a.s.l.,
annual precipitation 500 - 750 mm per year,
average annual temperature from 7 to 8.5 °C

The focuses

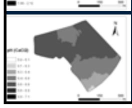
- **improving fast and reliable mapping of soil properties**
- **the relation between sensor outputs and soil properties**

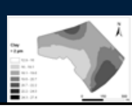
Soil sampling and soil properties determination

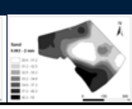
39 locations

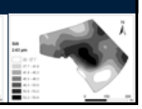
The field was sampled and geophysical measurements were done by the group of researches from the Czech University of Life Sciences (CULS), from the Helmholtz Centre for Environmental Research (UFZ) and from the Soil Company (TSC) in the spring and autumn of 2009.

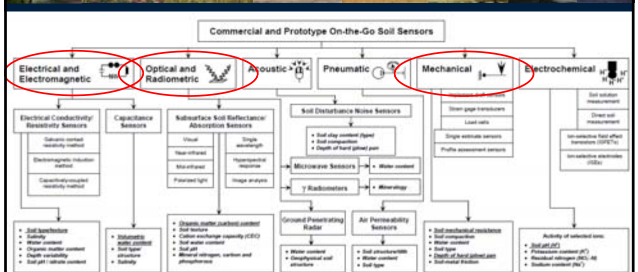
- **Soil organic carbon (SOC %)**
- **pH ($CaCl_2$)**
- **Particle-size distribution (clay, sand and silt - %)**



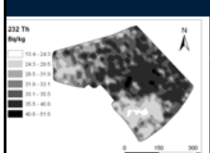


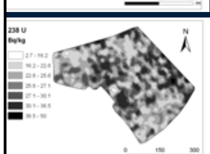






Adamchuk, V. I., Viscarra Rossel R. A. 2010. Development of On-the-Go proximal soil sensor systems. In: Proximal Soil Sensing, Progress in Soil Science, edited by R. A. Viscarra Rossel, A. B. McBratney, B. Minasny, Springer Netherlands, Netherlands, pp. 15 - 28.



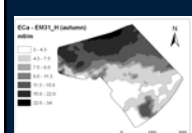


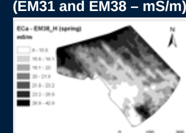
Five sampling research projects were undertaken.

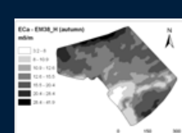
- **The first was conducted by The Soil Company (TSC) which collected gamma measurements - The Mole system**
- **four variables ^{137}Cs, ^{232}Th, ^{238}U, ^{40}K, (Bq/kg).**

Five sampling research projects were undertaken.

- **The second sampling project conducted by The Helmholtz Centre for Environmental Research (UFZ), was the measurement of electromagnetic induction ECa**
- **(EM31 and EM38 – mS/m)**

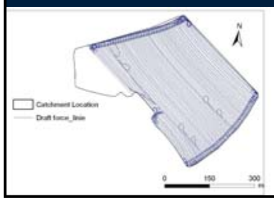




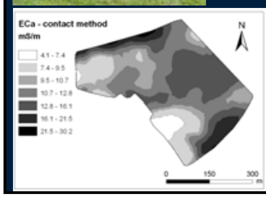


Five sampling research projects were undertaken.

- The third sampling project was conducted by CULS.
- Electric conductivity ECa and draft force were measured

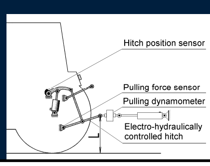


- A galvanic contact resistivity method was used

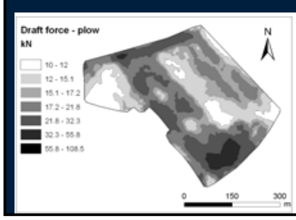


Draft force

- Measuring frame with one shovel
- Measuring during ploughing by means of tractor with an electro hydraulically controlled hitch



- The seven-blade plough Kverneland was attached to the tractor John Deere 8320.

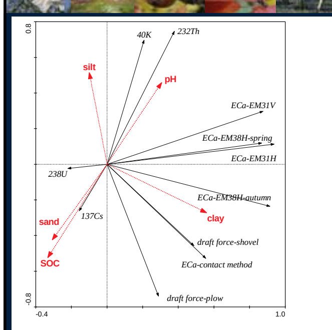


For the data sets analysing, CANOCO 4.5 package was used.

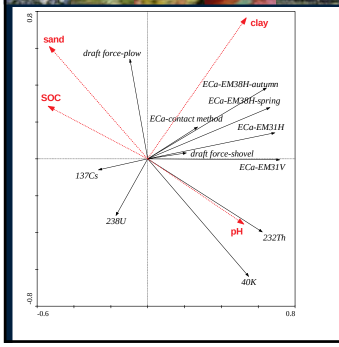
The linear methods (PCA and RDA) for studying data set variability were applied.

Clay, sand and silt content, further organic matter content and pH were chosen as explanatory variables.

As dependent variables the conductivity data (EM31 horizontal mode, EM31vertical mode, EM38 horizontal mode (spring measuring), EM38 horizontal mode (autumn measuring) and Galvanic contact resistivity sensor – profile 0-300 mm), gamma ray sensor, draft forces were used.



Principal component analysis (PCA) was used to assess the overall variation patterns in data set.
For better interpretation, the explanatory variables values were passively projected onto an ordination scatter plot.



The relative importance of each explanatory variable for the variation in data set was evaluated using redundancy analysis (RDA)

The effects of explanatory variables on dependent variables

Explanatory variables	Eigenvalue	F-ratio	p-value
all	0.422	4.556	0.001
clay	0.144	4.706	0.002
sand	0.130	4.196	0.004
SOC	0.110	3.451	0.003
pH	0.087	2.653	0.02

According to RDA, effects of all variables were statistically significant. All variables explained together 42.2 % of the total variation. Most variation was explained by particle-size distribution (clay content explained 14.4 % of variability, sand content 13.0 %), followed by SOC (11.0 %) and pH (8.7 %).

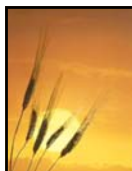
Conclusion

Clay: increasing clay content caused increase of conductivity, draft force values. ^{137}Cs and ^{238}U were negatively correlated with the increasing clay content.

Sand: Increasing sand content positively influenced tillage values (increase of draft force values) and ^{137}Cs, and negatively influenced were ^{232}Th and ^{40}K values.

SOC: With increasing SOC, draft force values were positively correlated. On the other hand ^{232}Th and ^{40}K values were correlated negatively.

pH: Increasing pH values were quite strongly positively correlated with increasing ^{232}Th and ^{40}K, while correlation with ^{137}Cs was negative. pH was also slightly correlated with conductivity values.



Thank you for your attention

Milan Kroulík