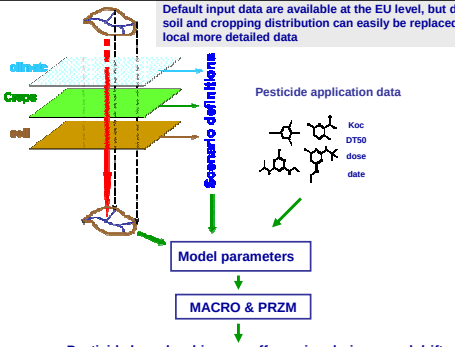
First applications of FOOTPRINT in Member States: the example of Denmark

Jeanne Kjær, Per Rasmussen, Bo V. Iversen, Peter Van da Keur, Annette Rosenbom, Anker Højbjerg, Erik Nygaard, Christen D. Børgesen, Mette Balslev Greve & Mogens Greve

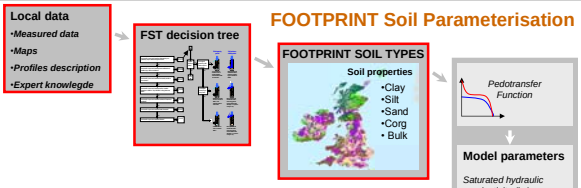
Geological Survey of Denmark and Greenland
Faculty of Agricultural Sciences, University of Aarhus

Default input data are available at the EU level, but data on soil and cropping distribution can easily be replaced by local more detailed data



Pesticide loss: leaching, runoff, erosion drainage and drift

FOOTPRINT Soil Parameterisation



Are the FOOTPRINT approach suitable for a small country like Denmark ?

- *Does the FST decision tree capture the variability?*
- *Are the FOOTPRINT soil and model parameters representative for Danish conditions?*
- *Are the model output trustworthy?*

Available soil data in Denmark

> **Profile database**
- >2000 soil profiles
- >9000 pedological horizons

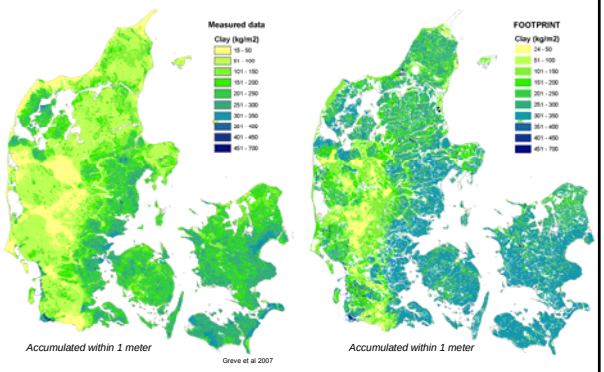
> **Soil texture database**
- >40.000 points for A-horizon
- >8.000 points in B-horizon
- >2.000 points in C-horizon
- 4 texture classes + org. matter

> **Soil classification map (JB)**
- Combining data from the texture and profile databases
  - Interpolated via kriging
  - National raster map
  - 4 texture classes + org. matter + bulk density
  - Three horizons (Ap, B and C)

FOOTPRINT soil type map

- 71 FOOTPRINT soil types
- 14 dominating soil types covering 90% of the area

Clay distribution in Danish soils

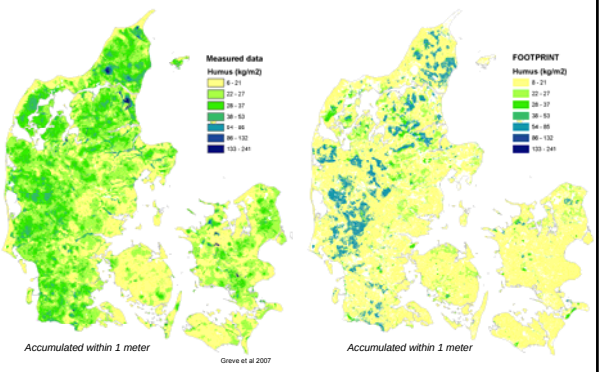


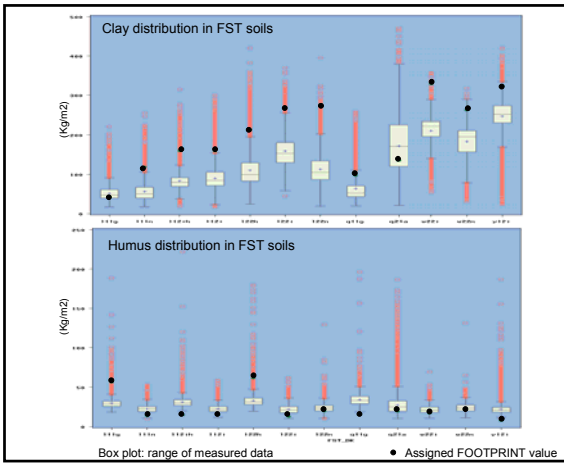
Accumulated within 1 meter

Greve et al 2007

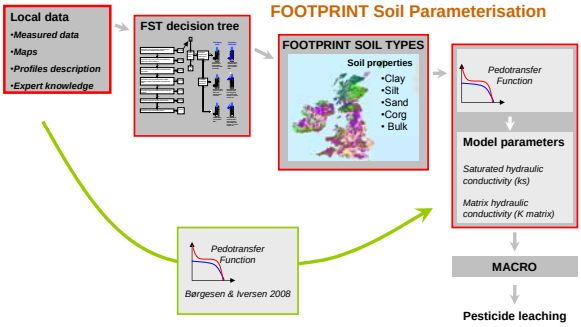
Accumulated within 1 meter

Humus distribution in Danish soils





FOOTPRINT Soil Parameterisation



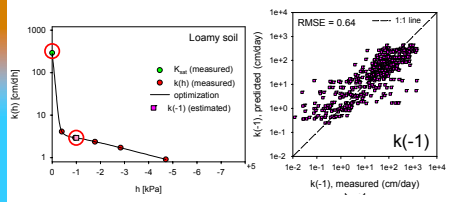
Development of Danish pedotransfer functions

Hydraulic measurements

- 68 locations (A, B and C horizons)
- Saturated hydralic conductivity (800)
- Near saturated hydralic conductivity (500)
- Water retention (1600)

Pedotransfer functions

- Saturated hydraulic hydraulic conductivity (ks)
- Near saturated hydraulic conductivity =Saturated matrix conductivity (Kh)



Iversen et al 2008

www.eu-footprint.org

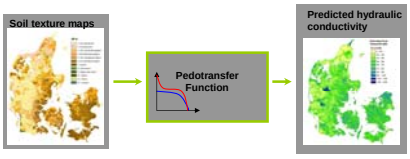
Development of Danish pedotransfer functions

Hydraulic measurements

- 68 locations (A, B and C horizons)
- Saturated hydralic conductivity (800)
- Near saturated hydralic conductivity (500)
- Water retention (1600)

Pedotransfer functions

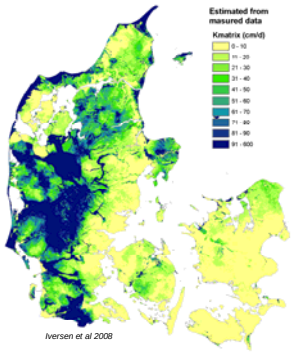
- Saturated hydraulic hydraulic conductivity (ks)
- Near saturated hydraulic conductivity =hydraulic conductivity of the matrix

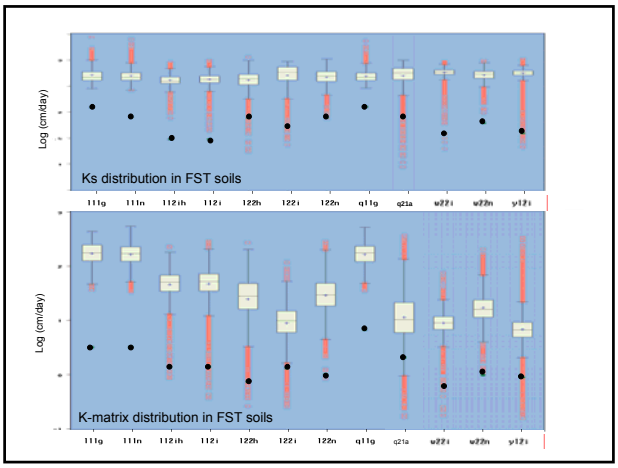


Iversen et al 2008

www.eu-footprint.org

Saturated matrix conductivity in B horizon (Kmatrix)





FOOTPRINT Soil Parameterisation

Local data
- *Measured data*
- *Maps*
- *Profiles description*
- *Expert knowledge*

FST decision tree

FOOTPRINT SOIL TYPES

Soil properties
- Clay
- Silt
- Sand
- Corg
- Bulk

Pedotransfer Function

Model parameters

Saturated hydraulic conductivity (ks)

Matrix hydraulic conductivity (K matrix)

Climate
Crop
Pesticide

MACRO

Pesticide leaching

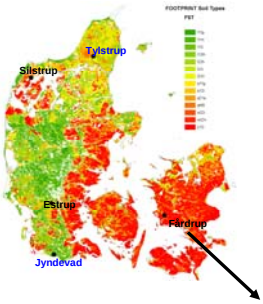
Modeling result are not yet available

Very first step …. "are we on the right track approach?"

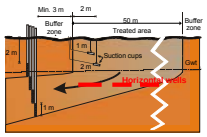
Consistency in ranking the leaching risk form selected sites:

- *Monitoring data*
- *Detailed MACRO 5.1 modelling (site specific climate and soil)*
- *FOOTPRINT results*

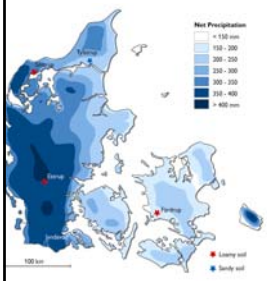
Ranking the leaching risk form PLAP sites (monitoring data + Macro 5.1)



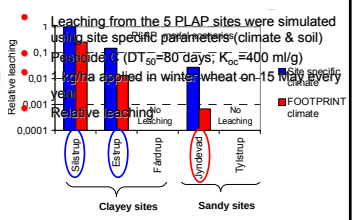
Pesticide leaching assessment programme
- Extensive pesticide monitoring program
- 3 clayey and 2 sandy sites (1 – 2 ha)
- ~ 10 years of monitoring data
- 38 pesticides (+ metabolites)
- MACRO 5.1 was parameterised using measured site specific data
- MACRO 5.1 was calibrated and validated on water balance and bromide leaching



Ranking the leaching risk form PLAP sites (monitoring data + Macro 5.1)

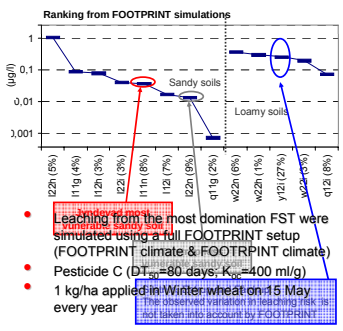


- Leaching decreased when using the FOOTPRINT climate
- Ranking the leaching risk from *monitoring data* were consistent with that proposed by *MACRO 5.1* (site specific and footprint climate)



- Leaching from the 5 PLAP sites were simulated using site specific parameters (climate & soil)
- Pesticide C (DT_{50}=80 days; K_{oc}=400 ml/g)
- 1 kg/ha applied in winter wheat on 15 May every year
- Relative leaching

Ranking the leaching risk form PLAP sites (FOOTRPINT)



- Leaching from the most domination FST were simulated using a full FOOTPRINT setup (FOOTPRINT climate & FOOTPRINT climate)
- Pesticide C (DT_{50}=80 days; K_{oc}=400 ml/g)
- 1 kg/ha applied in Winter wheat on 15 May every year

Conclusions

- The FOOTPRINT approach were found to be suitable for Denmark
- The variability of the soil properties was well captured on the sandy soil
- A consistency between FOOTPRINT and "local data" (monitoring & model) in ranking the leaching risk on sandy soils was found
- Parameterization of the loamy soils needs to be refined
- Care should be taken when interpreting the spatial variation of FOOTPRINT results at the national scale since variations in climates are not taken into account
- Additional evaluation comparing model output with measured data needs carrying out

www.eu-footprint.org

Acknowledgements

The funding of the FOOTPRINT project
by the European Commission
through its Sixth Framework Programme
is gratefully acknowledged

www.eu-footprint.org

i.dubus@eu-footprint.org