



Significance of soils as C stores

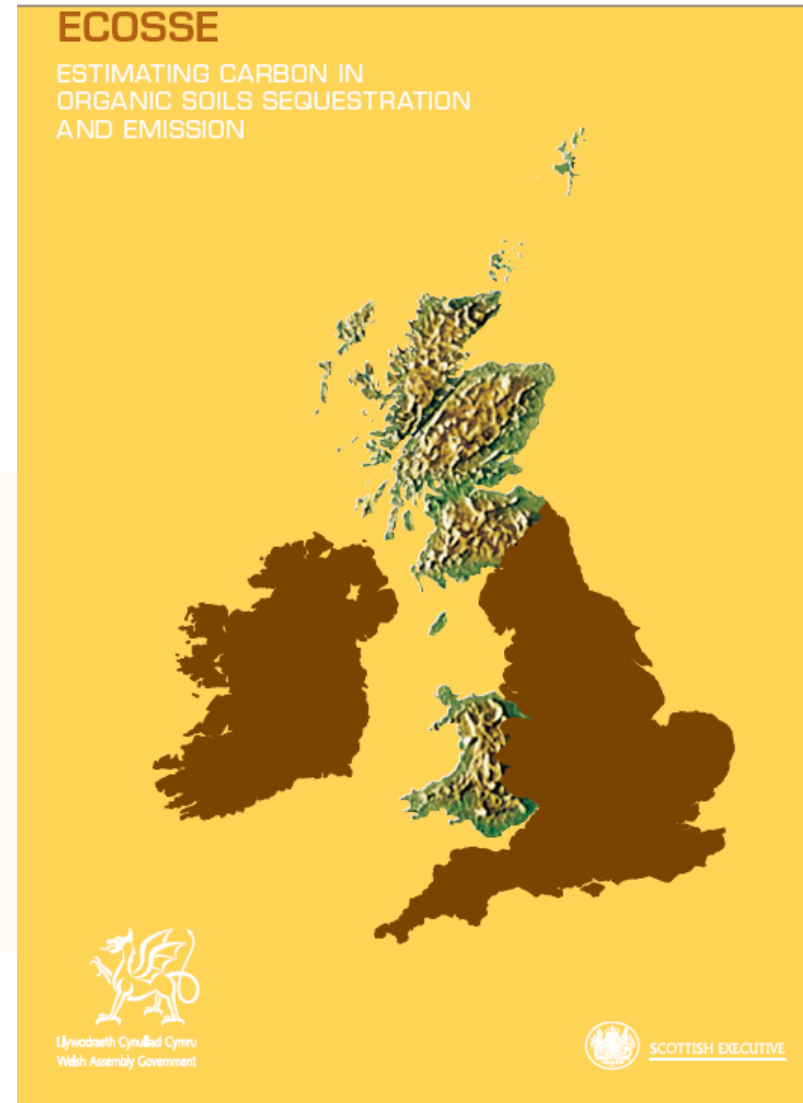
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Aims:

- develop a model to predict impacts of climate change and GHG emissions from organic soils

Key finding:

- Uncertainty remains over C stocks in Scotland and Wales
- Remote sensing techniques may be effective in reducing this uncertainty





Significance: soils as stores of organic carbon

Soils in northern Ireland are a significant store of terrestrial organic carbon.

Traditional methods of estimating C stocks have large uncertainties between measurement locations.

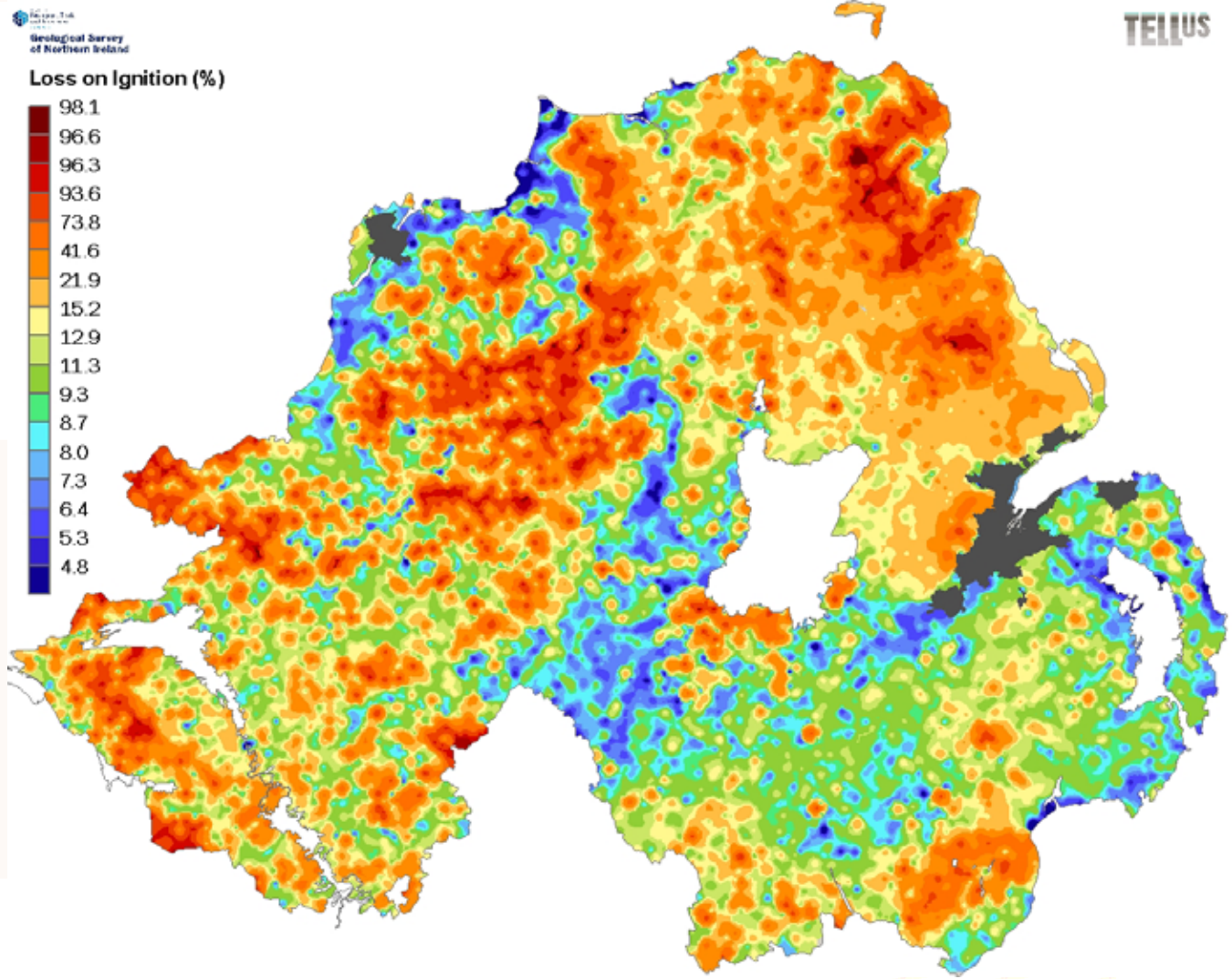
Secondary data sources include: **hyperspectral airborne data** (Selige et al., 2006), **surface reflectance** (Chen et al., 2005), **electrical conductivity** (Simbahan et al., 2005)

Radiometric survey data may be a very useful secondary data to improve estimates of soil organic carbon - untested



Map of Loss On Ignition for Northern Ireland

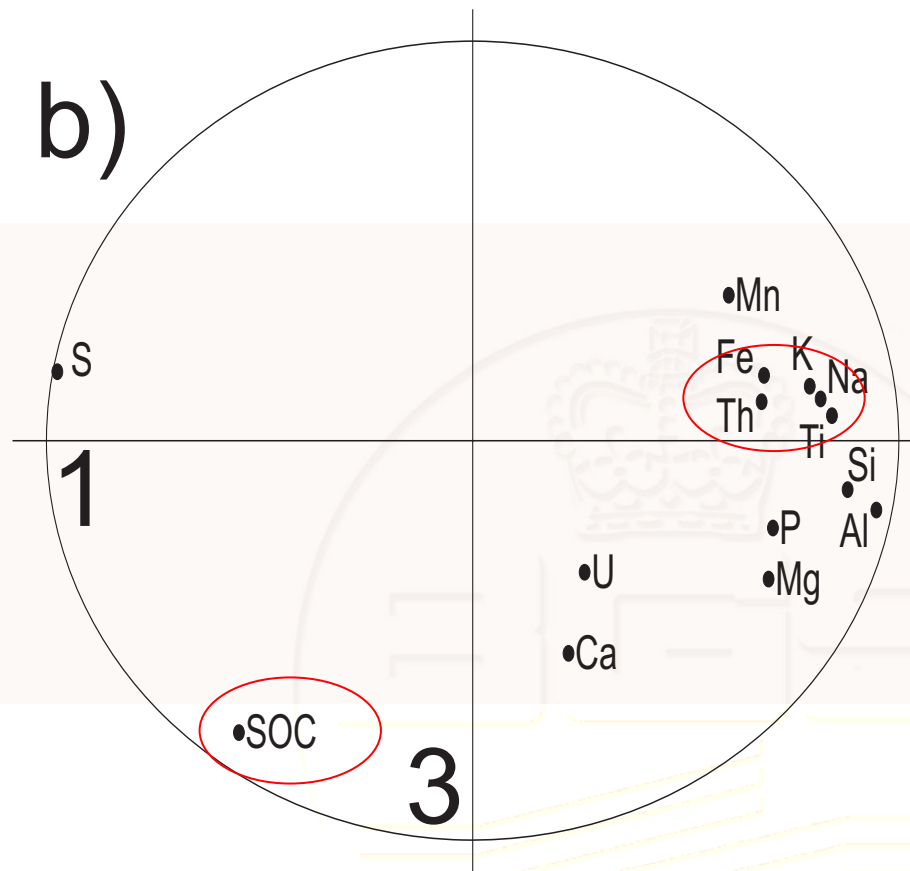
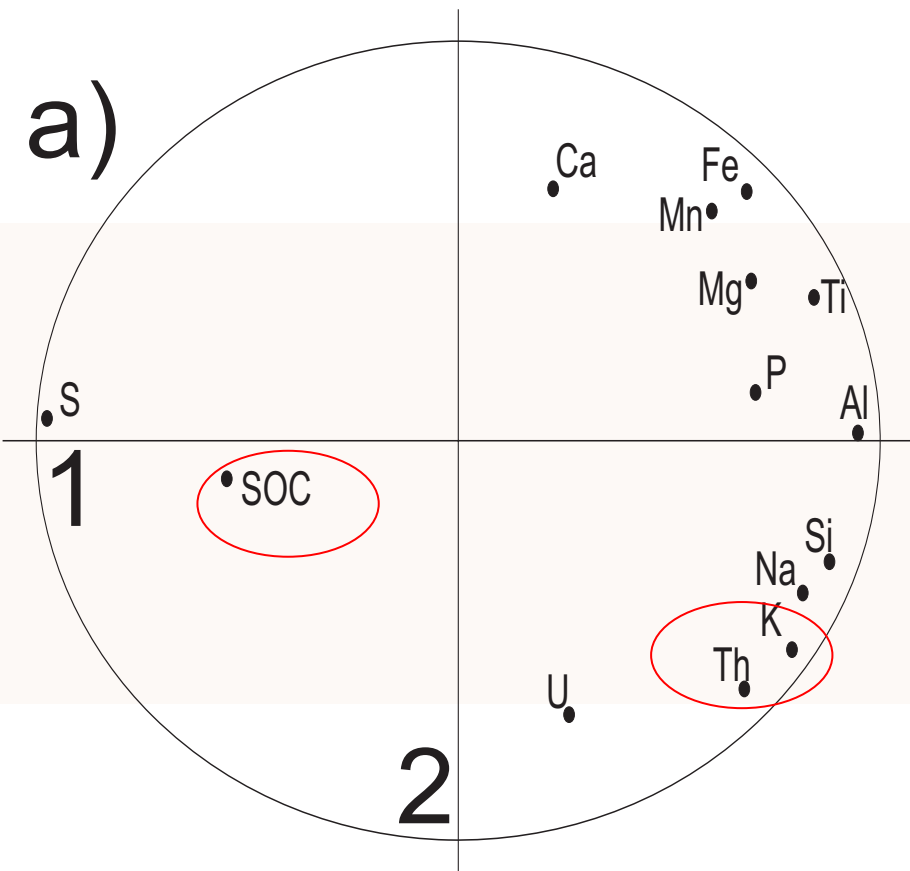
$$\text{SOC} \sim 0.58 * \text{LOI}$$



TELLUS



Principal component analysis for 6842 TELLUS soil samples (major and radiometric trace elements): a) first (52% of the variance) and second (20% of the variance) PC b) first and third (10% of the variance) PC.





Estimation method - procedure known as kriging.

Provides an estimate of a soil property at an unsampled location, and an estimate of the **uncertainty**

Different methods of kriging are available.

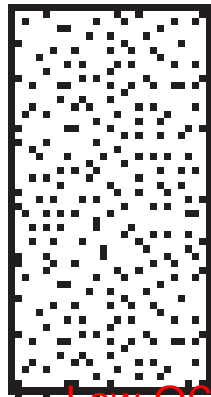
Can combine different secondary sources of data including altitude & remote sensing (such as airborne radiometric survey data): **co-kriging**

If the secondary data is spatially correlated with the primary data, we can use the former to reduce the uncertainty in the latter.

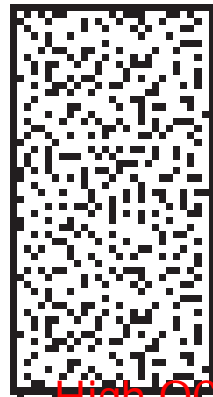


Secondary data used in this study:
Radiometric K, major component of rocks/soils

As soil organic carbon increases, mineral content
(including potassium, K) decreases.



Low OC

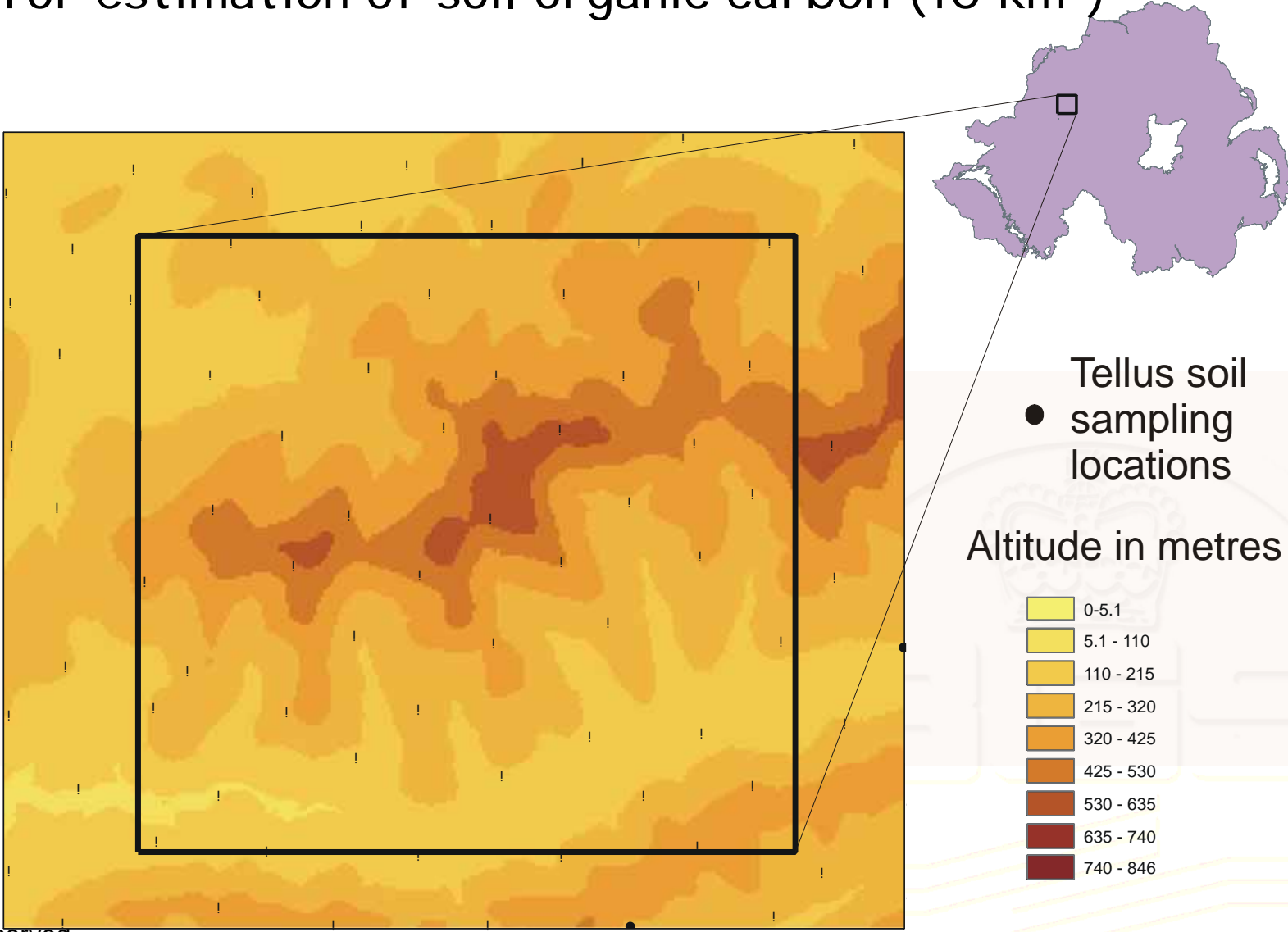


High OC

SOC tends to be greater at higher altitude because of
lower temperatures leading to slower decomposition.

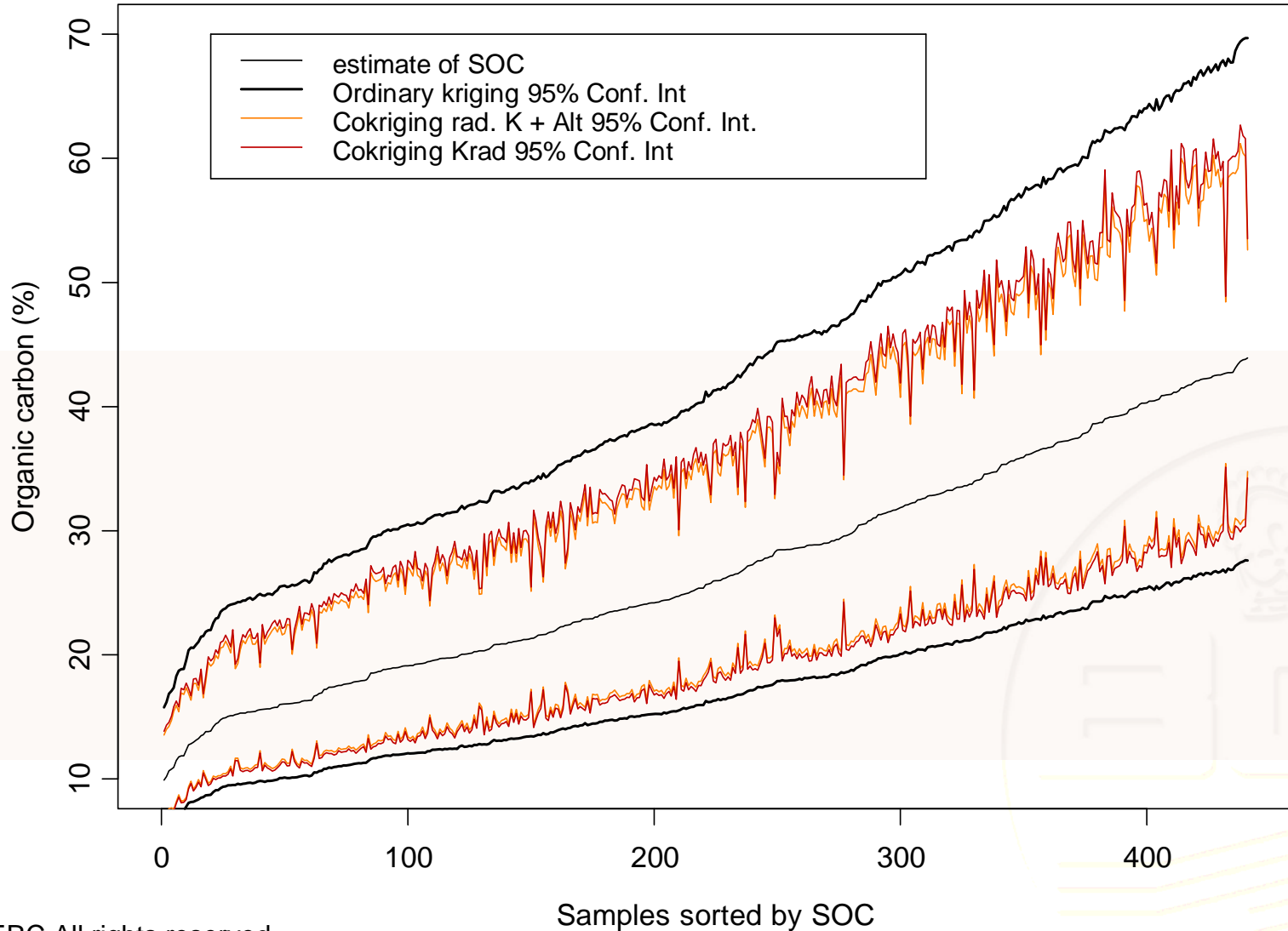


Test area for estimation of soil organic carbon (10 km²)





Estimates of Soil Organic Carbon and 95% confidence intervals for ordinary kriging and co-kriging with combinations of radiometric K and altitude on a 0.5 km grid

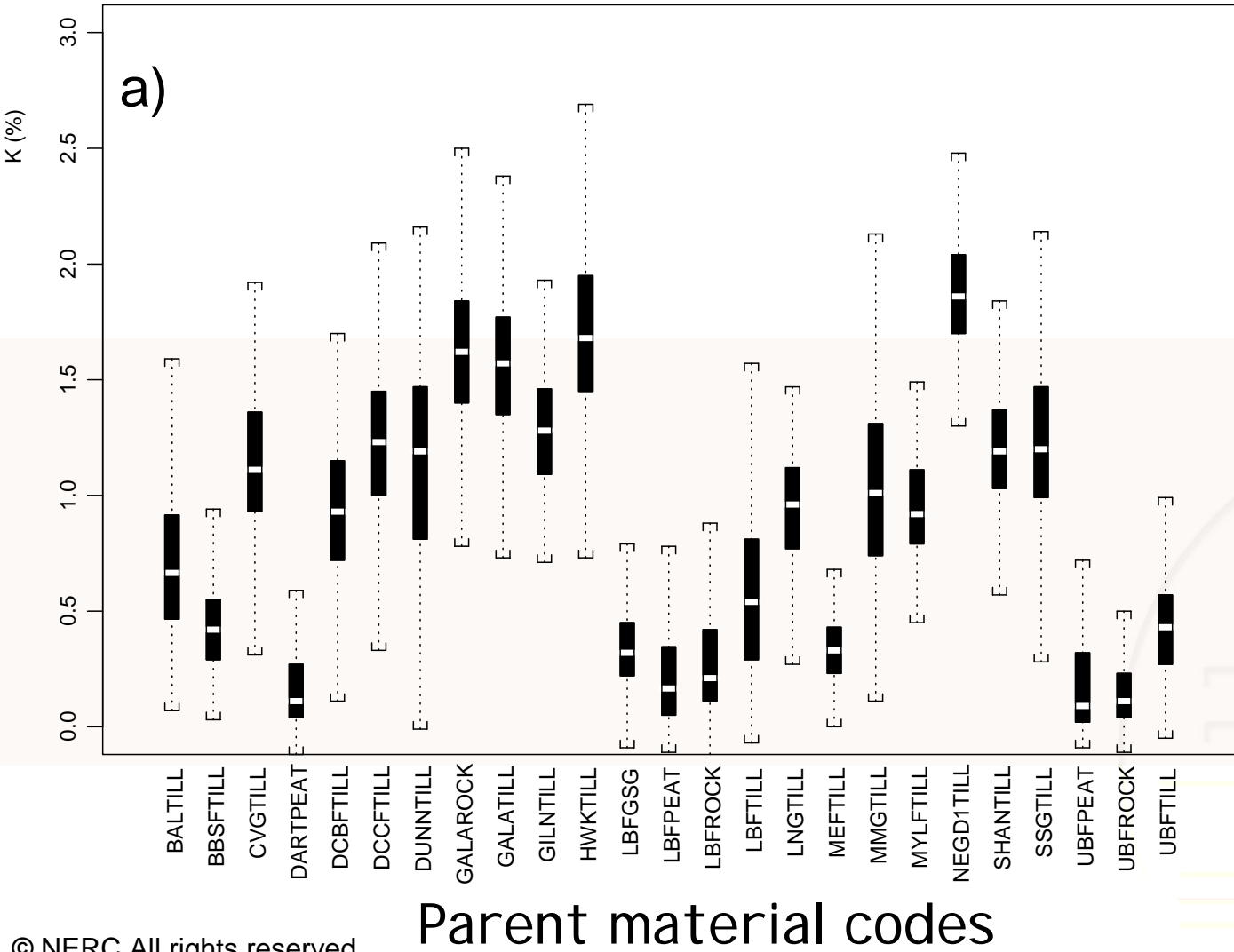




Box and whisker plot of radiometric K by soil parent material

ANOVA Analysis:

68% of the variation in K is accounted for by the Parent material classification





Conclusions:

Radiometric survey data can be used to significantly reduce uncertainties of estimating soil organic carbon for NI .

This technique may be useful in other **organic-rich soils**.

This can aid better estimates of soil carbon stocks.

Radiometric K is very closely related to the distribution of soil parent materials and could aid their mapping at the local scale.



Spatial correlations between the SOC and secondary data

