Agricultural Outlook Forum
U.S. Department of Agriculture Presented: March 1-2, 2007

SOIL CONSIDERATIONS ACROSS THE LANDSCAPE

Hector Causarano

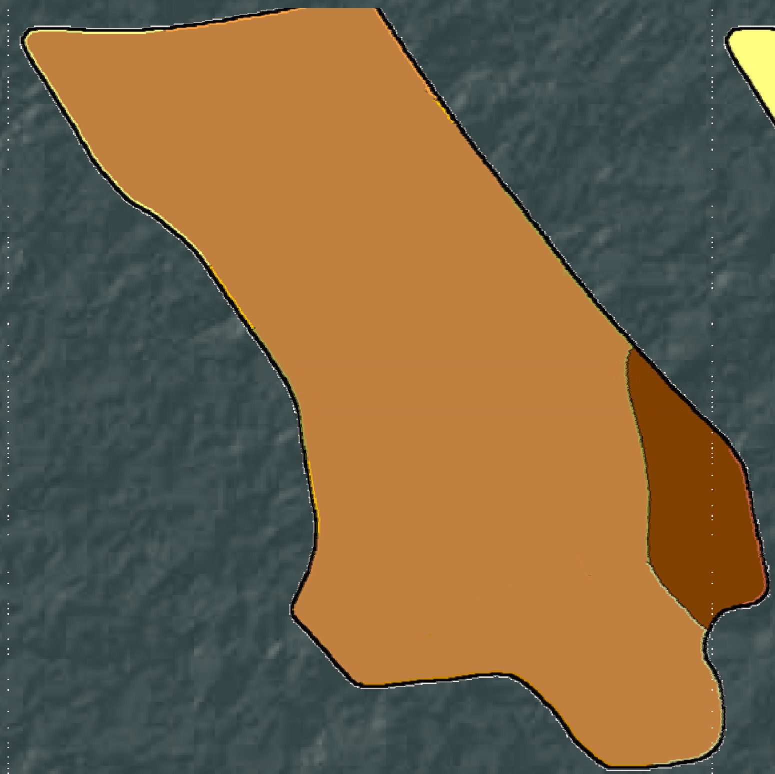
Soil Considerations Across the Landscape

Hector Causarano


Terra et al., 2003 and 2004

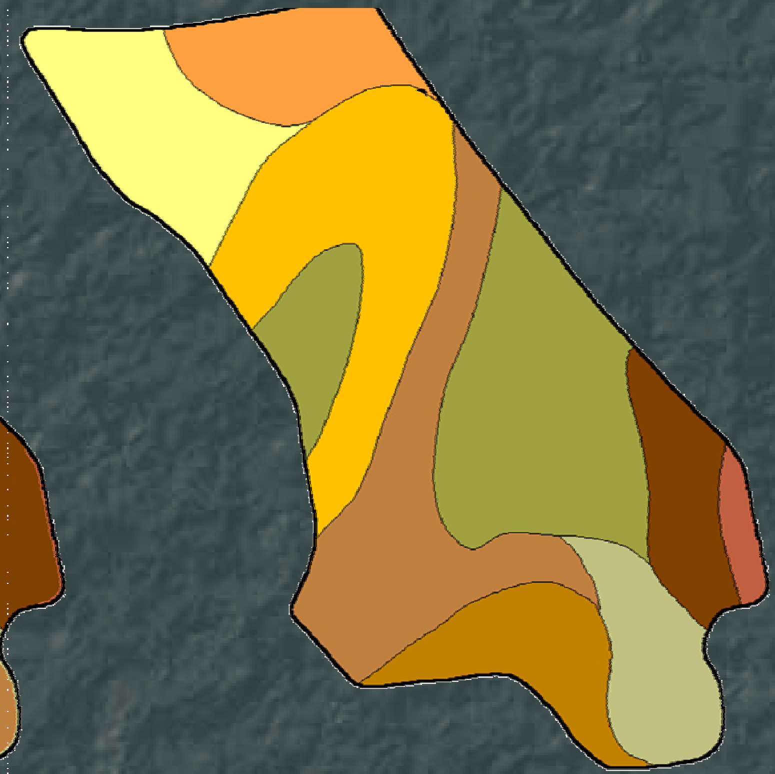
Soil Survey

Order 2 (SSurgo)



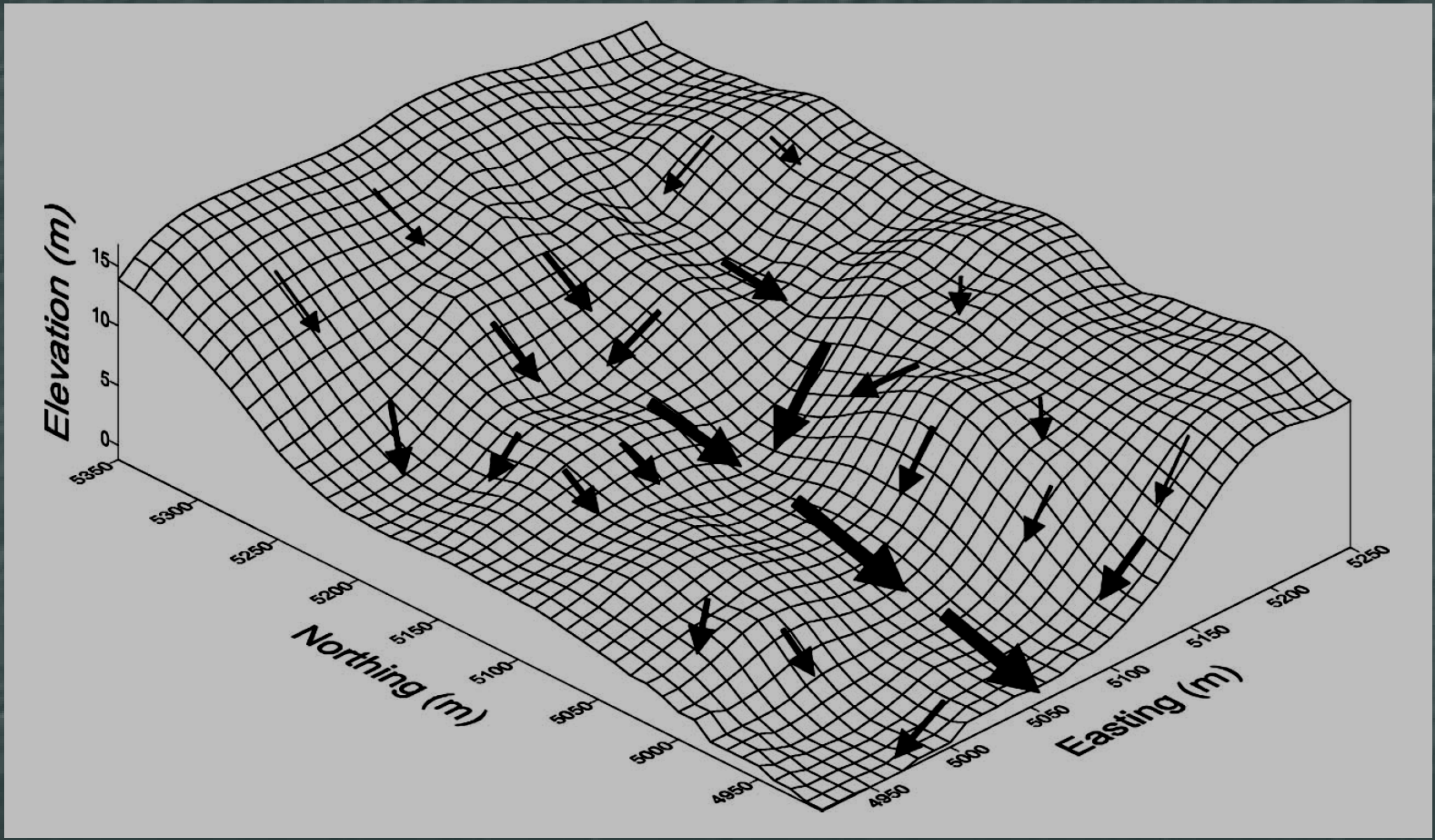
Scale 1:24,000

Order 1



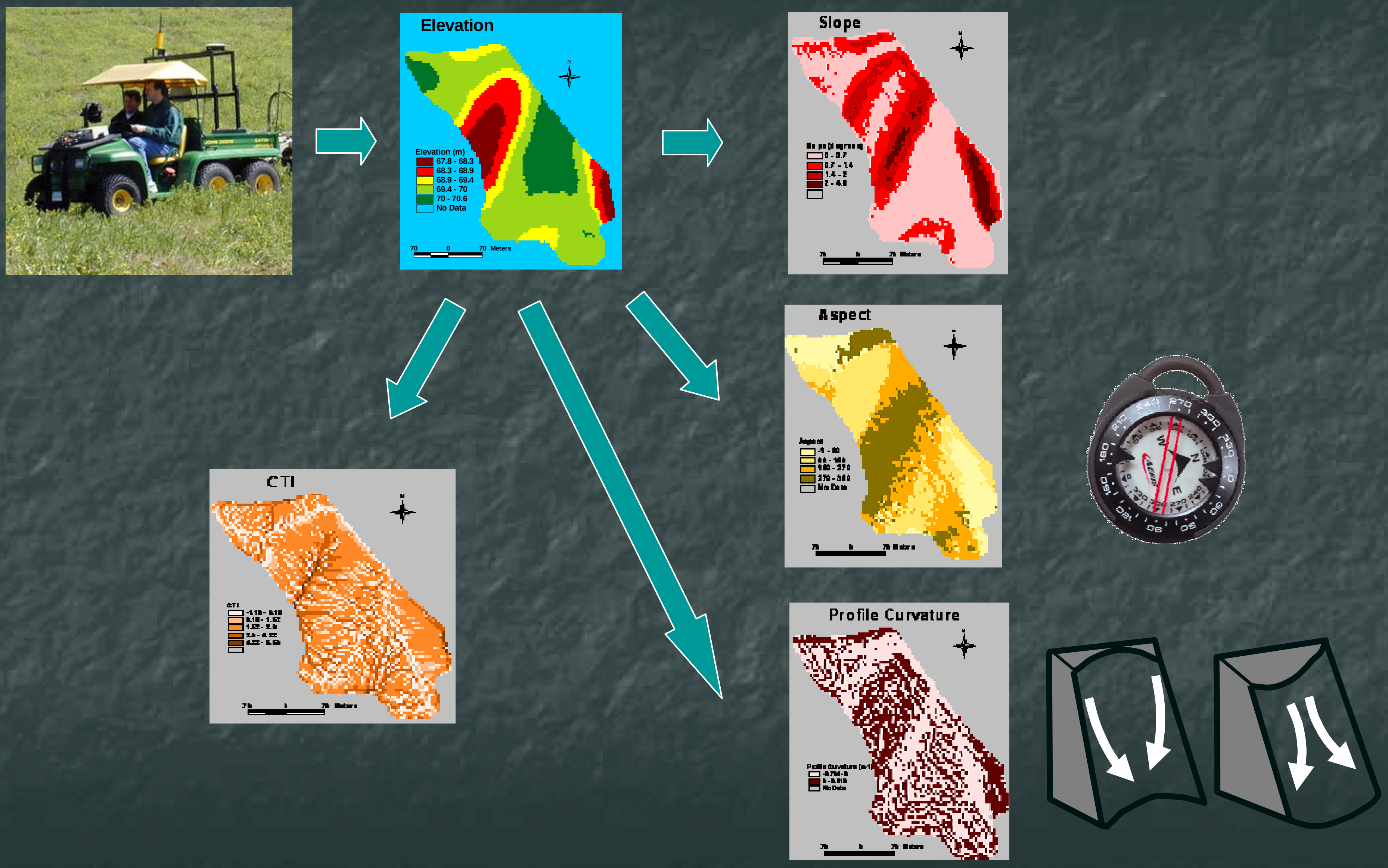
Scale 1:5,000

Schematic diagram of the pattern of water flow on a terrain surface



Pennock, 2003

Digital Terrain Models

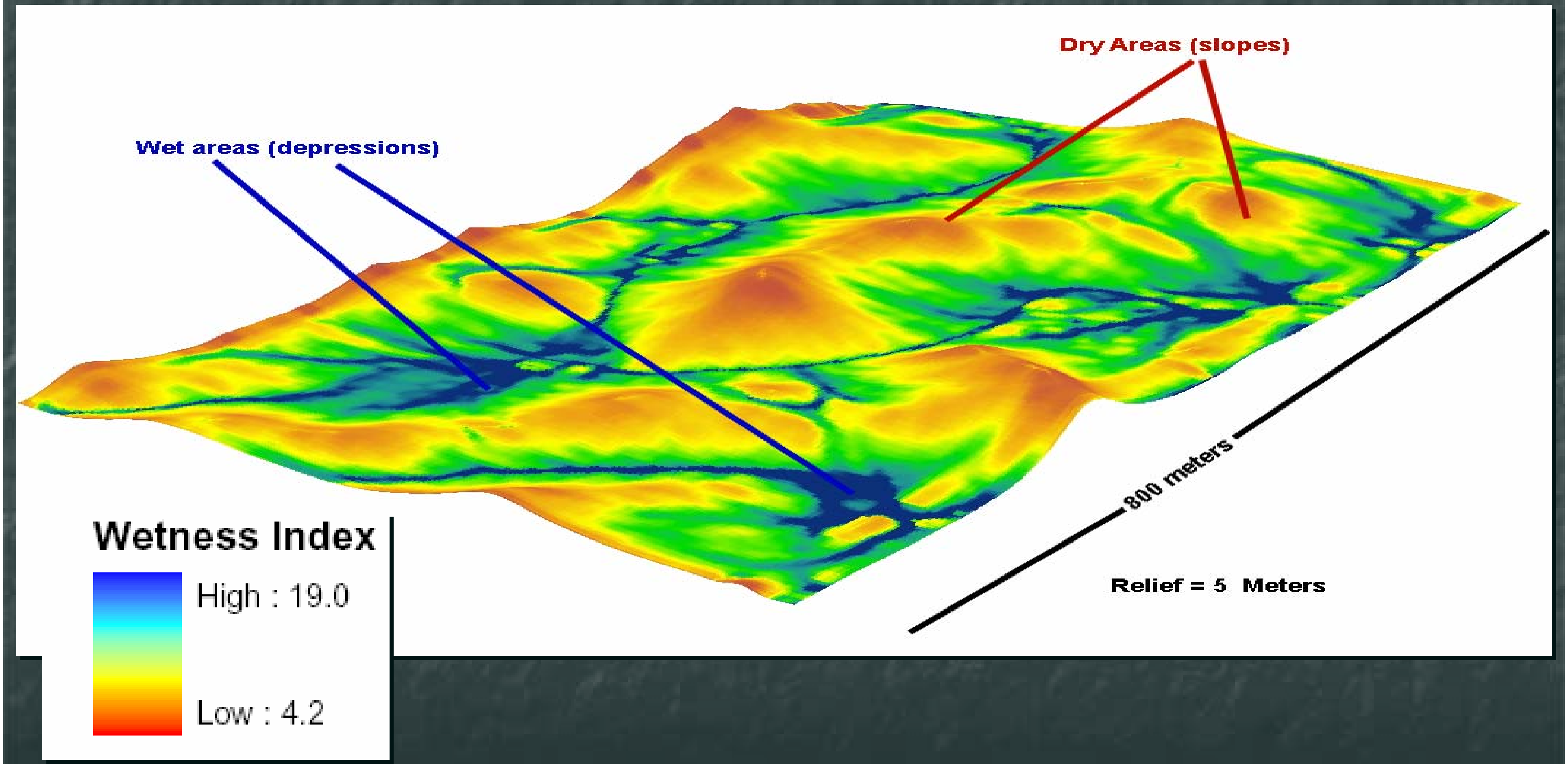


Pearson correlation coefficients between Terrain Attributes and Soil Organic Carbon

Location	Elevation	Slope	Aspect	Wetness Index
Duran, MI [1]	-0.72	-0.40	0.17	no data
Sterling, CO [2]	no data	-0.45	-0.13	0.57
Syracuse, NY [3]	0.08	-0.11	-0.22	no data
Shorter, AL [4]	-0.17	-0.41	no signific	0.48

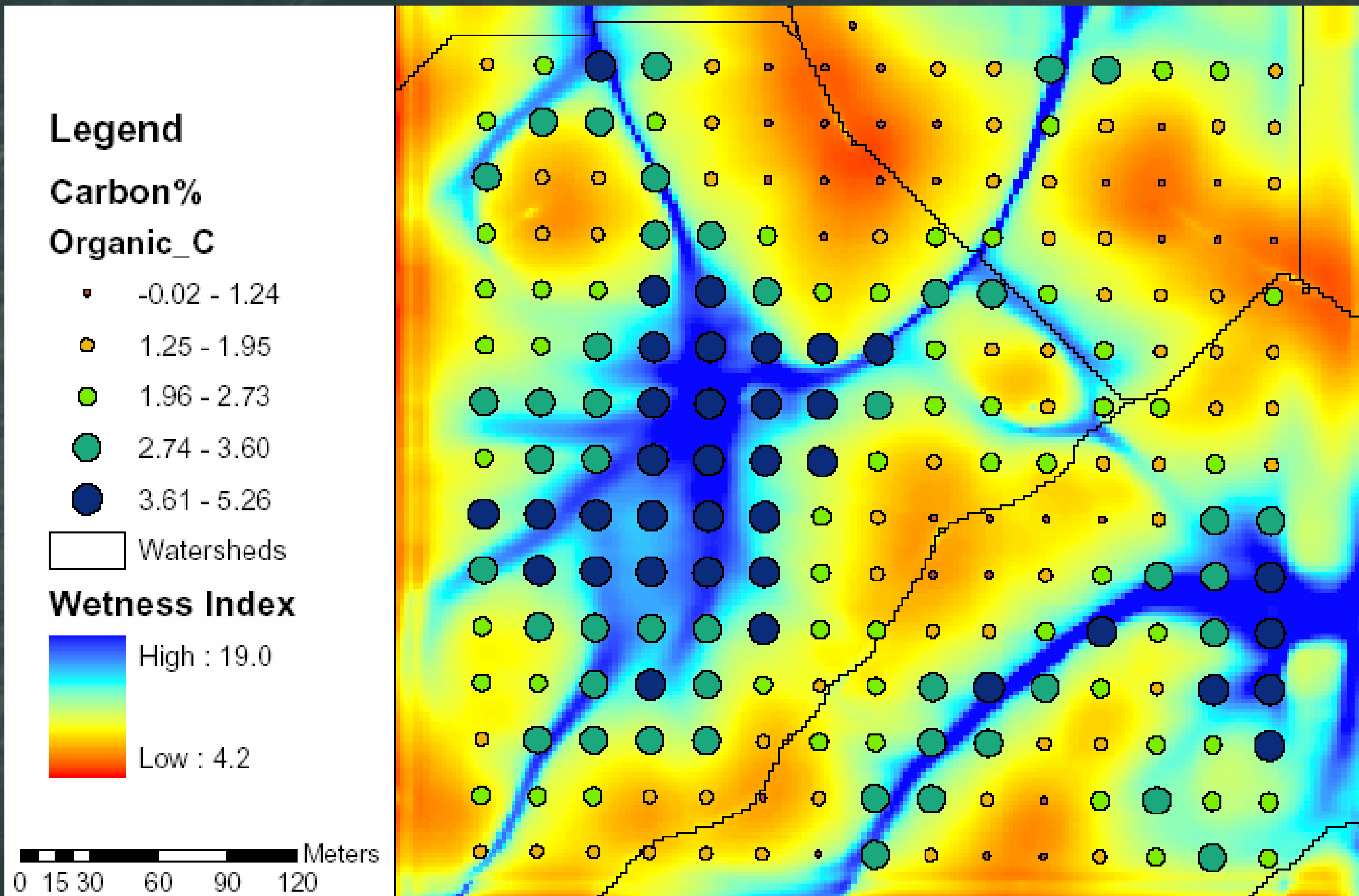
[1] Mueller and Pierce (2003); [2] Moore et al. (1993); [3] Johnson et al. (2000); [4] Terra et al. (2004)

Derivation of wetness index from the DEM



Venteris et al. (unpublished)

Model for soil carbon based on wetness index

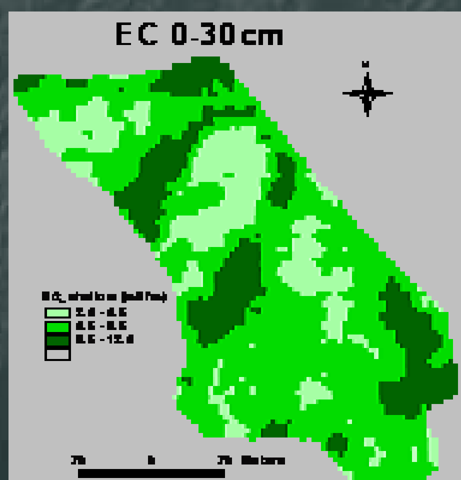


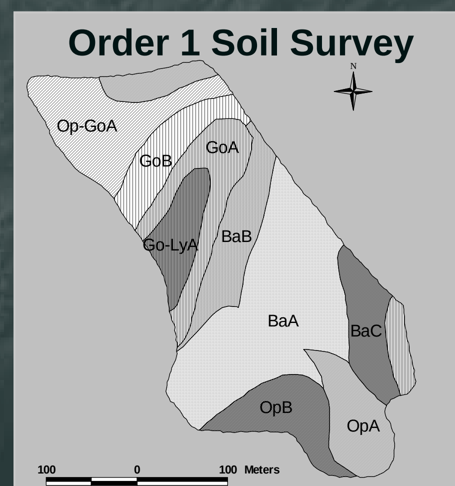
Venteris et al. (unpublished)

Soil Electrical Conductivity for mapping soil properties

Electrical resistivity

Electromagnetic induction

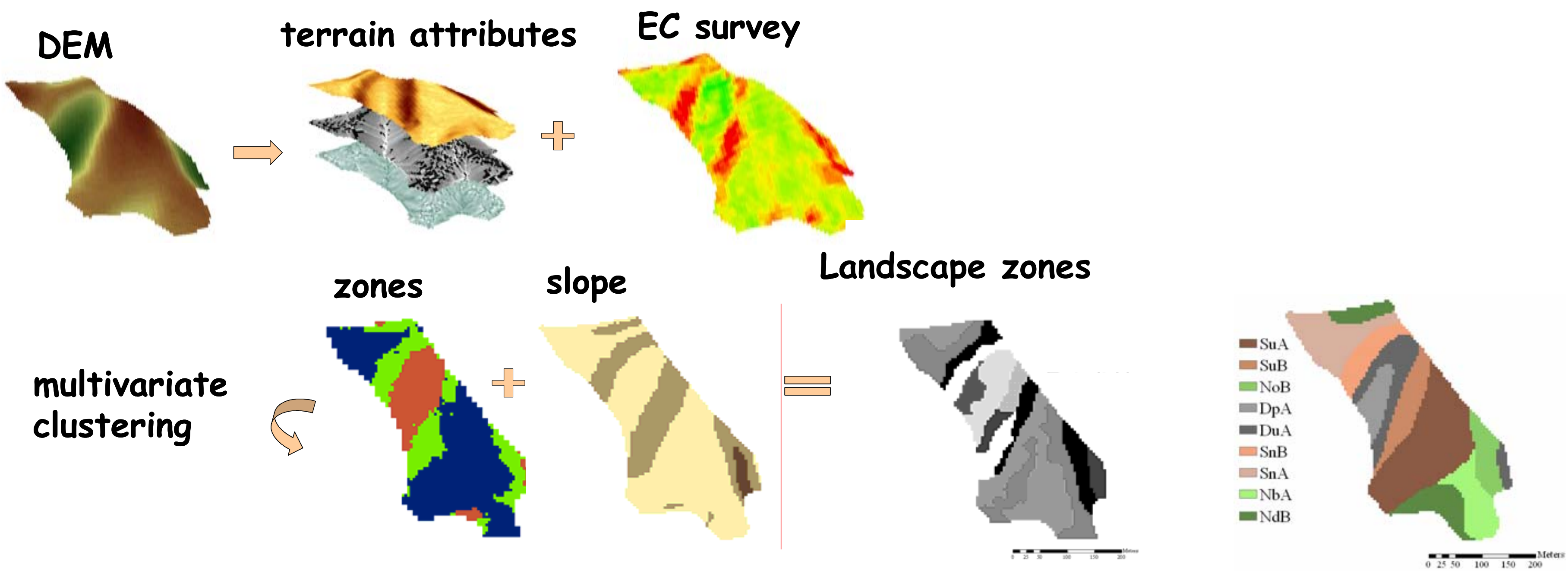




Terra et al. (2004)

Innovative Soil Survey

Multivariate Landscape Zones



White et al. (in review)

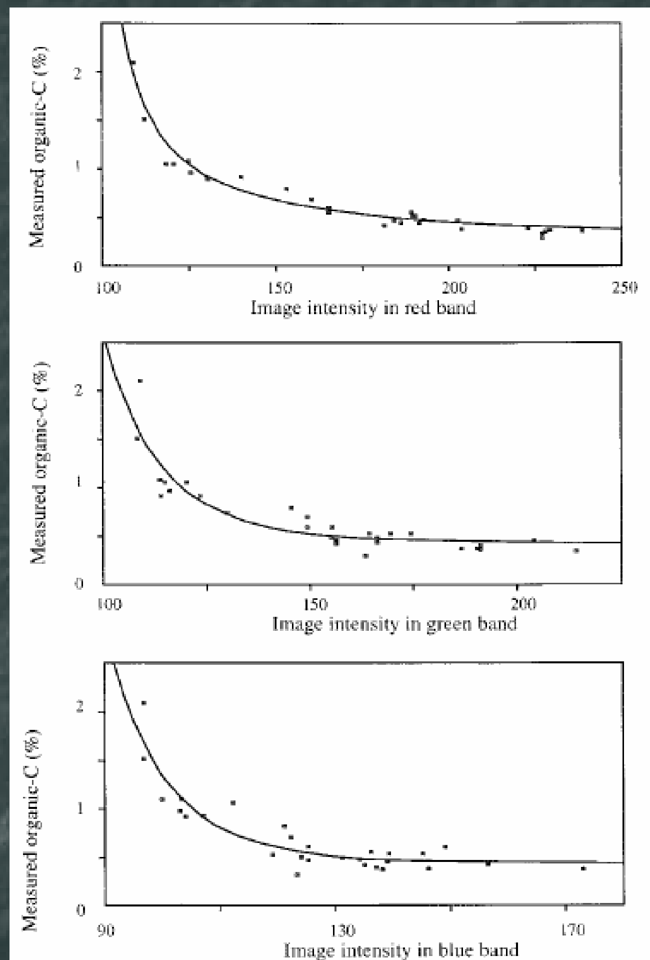
Correlation between EC and soil properties sampled at 0-30 cm depths

	Soil attribute	$EC_{shallow}$
1)	Vol. Water Content	0.22 ~ 0.87
	Sand	-0.04 ~ 0.88
	Clay	0.37 ~ 0.86
	CEC	0.24 ~ 0.86
	K	-0.05 ~ 0.24
	Ca	0.44 ~ 0.78
	Mg	0.28 ~ 0.93
2)	Total Carbon	-0.36 ~ -0.42
	Total Nitrogen	-0.36 ~ -0.38
3)	Clay	0.43
	Total Carbon	-0.31

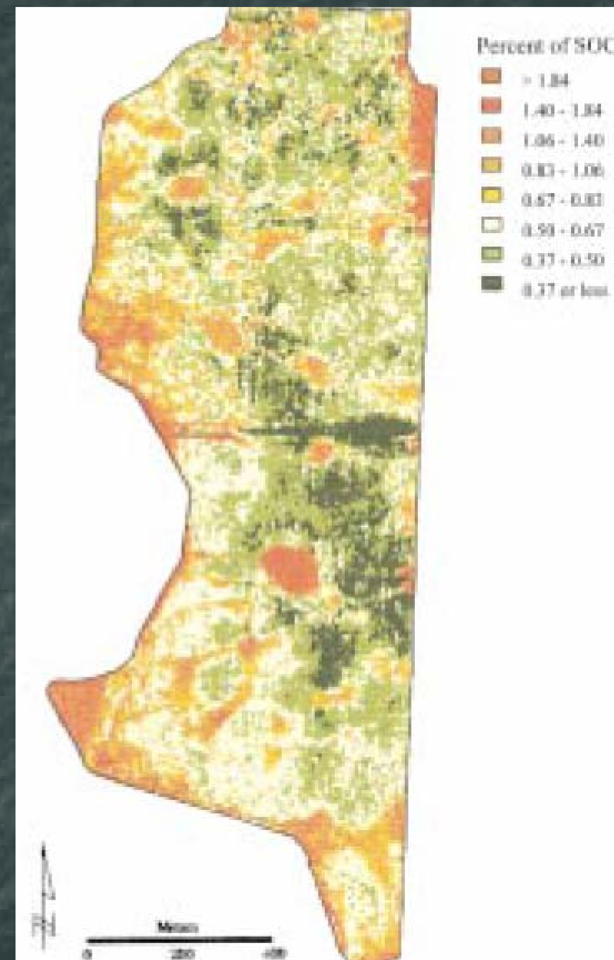
Adapted from: 1) Mueller et al. (2003); 2) Johnson et al. (2003), and Terra et al. (2004)

Field-Scale Mapping of Surface Soil Organic Carbon Using Remotely Sensed Imagery

Color image



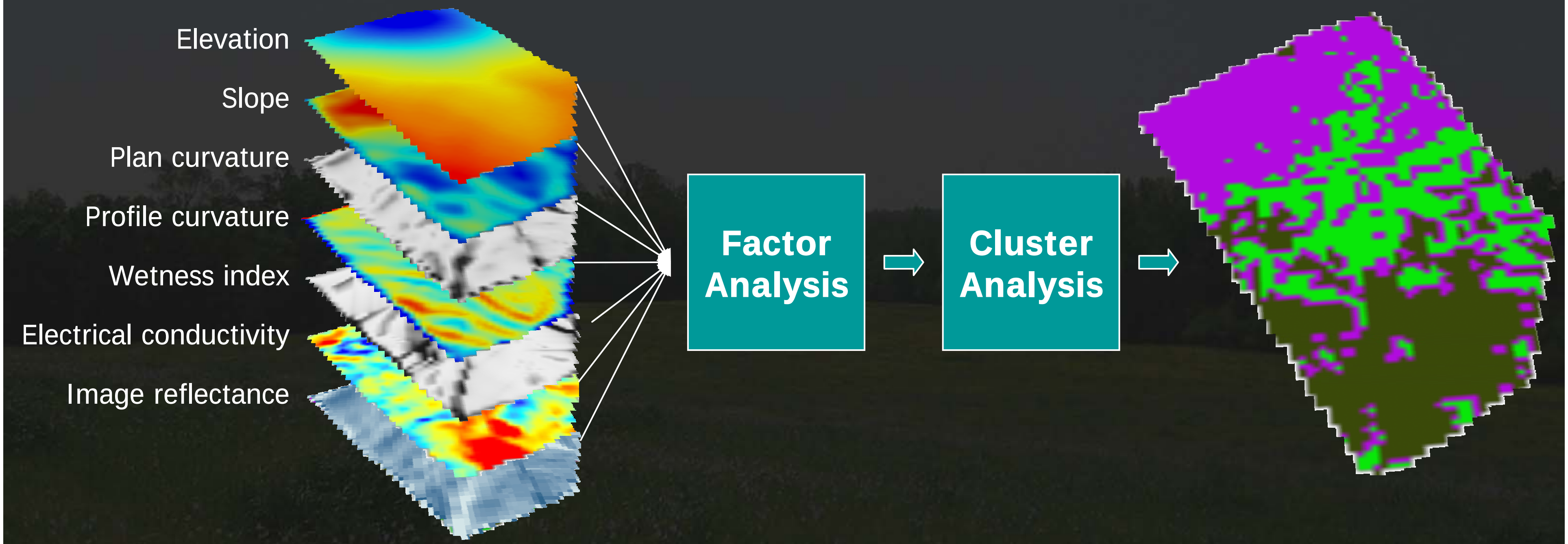
Fitted curves between soil organic C and image-intensity values.



Predicted soil organic C

Chen et al. (2000)

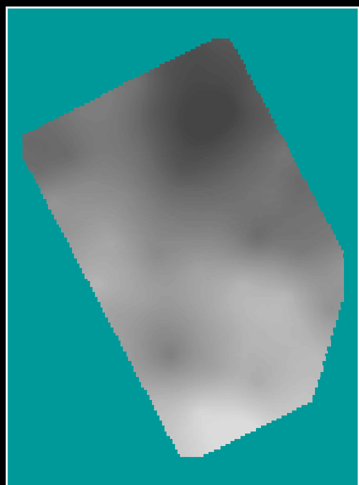
Overlay of soil organic C, terrain attributes, remote sensing and electrical conductivity data



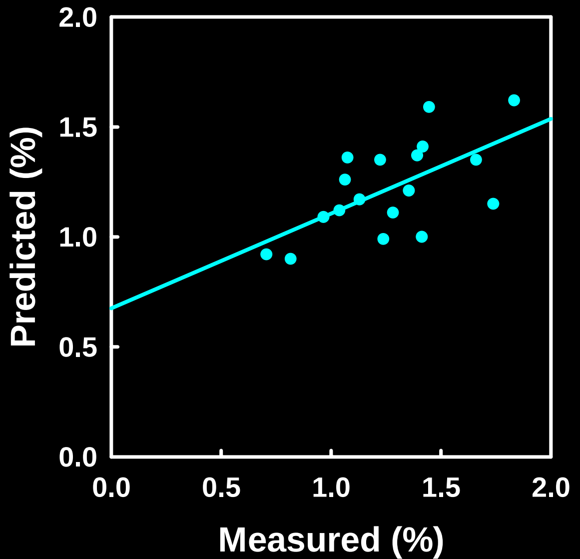
Causarano et al. (unpublished)

Soil organic C maps, Gold Hill

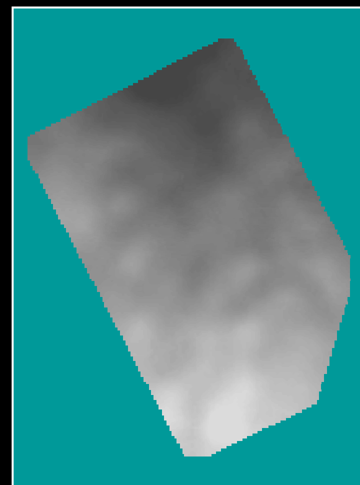
Kriging



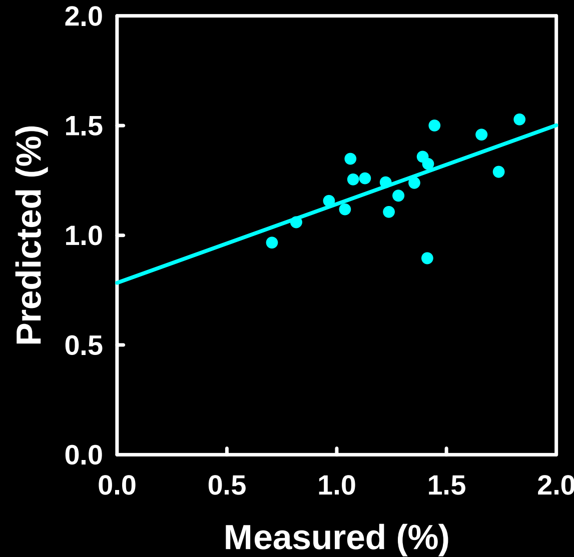
Prediction efficiency = 38.1%



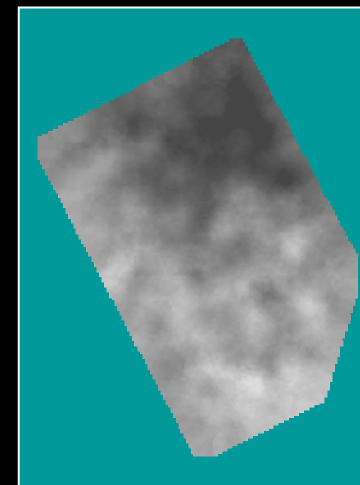
Multiple linear regression with factor scores



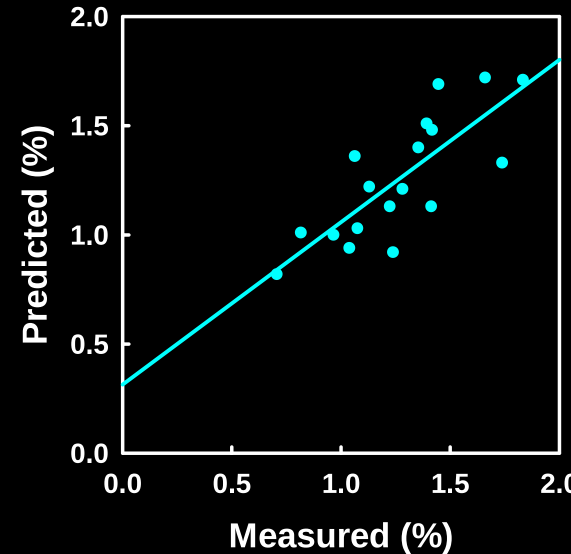
Prediction efficiency = 40.9%



Artificial neural networks



Prediction efficiency = 61.7%



Summary and Conclusions

- Soil properties are related to landscape forms and position.
- Terrain attributes, field-scale electrical conductivity and remote sensing can explain variability in soil properties.
- Factor analysis and multiple linear regression help to determine the most significant variables impacting a soil property at the field-scale.
- Cluster delineation is appealing because it objectively delineate homogeneous areas in the field.