Hierarchical Spatial Modeling of Multiple Soil Nutrients in Heterogeneous Patches of Land Use

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Land-use map of Phoenix 2000

- Org C - energy available for soil food webs.
- Inorg C - longterm water and salt balances.
- Soil - stores a large fraction of global C
- Nutrient pool sizes affect plant productivity
- Soils are a sink for anthropogenic nutrient pollution

Dependent variables: Tot N(TN), Organic C(OC), Inorganic C(IOC), Phosphorous(P)

Regressor variables: Spatial in nature.
Include a host of bio-physical and socio-economic covariates

Regressor variables significant in our model:
land-use, 0-1 variable whether ever in agriculture, %lawn, % impervious area, elevation

Previous research on soil nutrients:
multiple regression, ANOVA, no attempt to integrate all land-use or spatial structure, no attempt to model association of soil nutrients, no issue of prediction or model comparison

Challenges met in our model:
Multivariate Spatial structure, Heterogeneity of land-use patches, dimensionality, model comparison, missing data layers needed for prediction at new points.

Based on the model we generated values at 5000 new points.
The surface maps are given (Tot N and Org C):

Confidence interval of Correlation between Real and Median Predictions; log(Tot N) and log(Org C) under Hierarchical Spatial, Hierarchical Non-spatial, Non-hierarchical Spatial, and Non-hierarchical Non spatial Models

Real and Predicted Surfaces of log(Tot N) and log(Org C)