Digital Soil Mapping of Soil Properties in Korea

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This presentation estimates soil organic carbon and clay content at the 6 standard depths for Korean soils using the equal-area smoothing spline functions based on the GlobalSoilMap.net specification.
Data Used

Prediction

- A Korean soil database based on
  - “Taxonomical Classification of Korean Soils” (2000, NIAST, RDA)
  - mostly collected in 1970’s for soil profile description
  - 380 soil series (as of now 391 soil series in Korea)
  - Soil organic carbon: Tyurin method
  - Clay content: Pipette method

Validation

- Newly collected 168 soil series data (2009~2011)
  - used for independent validation
  - checking for the accuracy and uncertainty
  - Soil organic carbon: Walkley-Black method
  - Clay content: Pipette method
Methodology

The Spline tool version 2.0  ※ ASRIS 2011, Malone et al., 2010
- a generalisation of the quadratic spline model of Bishop et al. (1999)
  • standard depths: 0-5, 5-15, 15-30, 30-60, 60-100, 100-200 cm
  • 1-cm interval depth from 0-200 cm

Mapping depth-wise soil properties
- derived mean values from the fitted spline at standard depths
- matching soil series to the soil map polygons
- rasterized the results to 100 m grid according to G.S.M.net criteria

Validation/Uncertainty of prediction
- The spline predicted soil properties were resampled to match with the soil depth of recently collected soil profiles: 0 to 15~60 cm

※ GlobalSoilMap.net specification
Results

Distribution of soil organic carbon and clay content at different soil depth

<table>
<thead>
<tr>
<th>Standard depth (cm)</th>
<th>Organic carbon (g/kg)</th>
<th>Clay content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>median</td>
</tr>
<tr>
<td>0-5</td>
<td>12.7</td>
<td>9.8</td>
</tr>
<tr>
<td>5-15</td>
<td>11.7</td>
<td>9.4</td>
</tr>
<tr>
<td>15-30</td>
<td>8.3</td>
<td>7.1</td>
</tr>
<tr>
<td>30-60</td>
<td>4.5</td>
<td>4.9</td>
</tr>
<tr>
<td>60-100</td>
<td>3.2</td>
<td>2.9</td>
</tr>
<tr>
<td>100-200</td>
<td>3.3</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Predicted soil profile of organic carbon and clay content in 5 profile layers
Results

Scatter plot of predicted vs. recently measured organic carbon (left) and clay content (right) from 0 to 15~60 cm.
Results

Uncertainty
Expressed as RMSE

0~ ≒35 cm
(Mostly 0~below 20 cm)

RMSE_OC (g/kg)

RMSE_Clay (%)

≜15 ~ ≒40 cm

Root-mean-square errors on predictions for organic carbon and clay content in 2 profile layers
Soil organic carbon and clay content for Korean soils were estimated based on the equal-area smoothing spline and mapped corresponding soil series to produce spatial and depth-wise soil property maps.

Recent collected point data used as validation/uncertainty estimates.

Mapped clay content showed good agreement with recently sampled data.

Detailed soil map can create maps of continuous soil properties with great accuracy!
• Soil organic carbon map showed a high uncertainty which may be due to the dynamic nature of soil carbon

Sand, Silt, pH,...