Specifications for *GlobalSoilMap.net* products[1,2]

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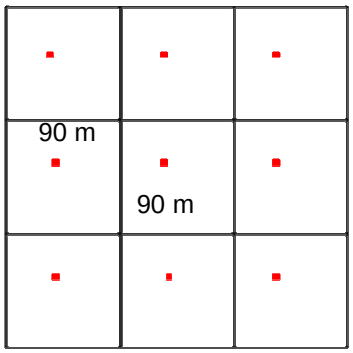
This section sets out the specifications for the output products that the *GlobalSoilMap.net* project will produce. The specifications are kept simple and basic. The specifications presented here do not prescribe how the outputs must be produced; only what they need to look like in order to permit collation and presentation of diverse data products in an integrated environment.

Spatial entity and resolution.

The spatial entity will be a notional profile to a depth of 2 m centred at a single point located at the centre of a grid cell with horizontal dimensions of 90 m by 90 m (3 x 3 arc-seconds).



The value reported for each 90 m by 90 m grid cell will represent a bulked mean within the entire extent of the grid cell. The value removes the short range variability in the value of a soil property within the extent of the 90 by 90 m grid cell. The uncertainty associated with estimation of a mean value for each reference depth within the full extent of a grid cell will be less than the uncertainty associated with estimation of a single value for each depth within the grid cell. The value reported for each 90 by 90 m grid cell will be an estimate of the mean value of a property over a specific depth range within the entire extent of the cell. Mean values may be computed using various approaches. One approach is block kriging utilizing values from surrounding locations to provide a smoothed estimate for the block. Another approach might be to process finer resolution data (e.g. 30 x 30 m cells) and then compute a mean value for the 90 m grid based on the values for these finer resolution cells.

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[1] Agreement on these specifications was achieved at the *GlobalSoilMap.net* node meeting in Seoul, Korea on October 25-26, 2009.

[2] Please note: These Specifications will only be effective if incorporated in specific project agreements signed by the parties, consistent with the Consortium Agreement.

The spatial resolution of 90 m by 90 m was selected for two reasons. Firstly, the SRTM DEM data available to describe the terrain surface worldwide has approximately these dimensions at the equator. Secondly, the 90 x 90 m dimensions provide an ability to describe soil variation at a resolution that can support field-scale management decisions.

Soil Properties.

The project has committed to producing estimates of property values, their uncertainty and their date of prediction at each of six specified depth increments (see below) for the following soil properties:

1. Organic Carbon (g/kg)
2. Particle Size Distribution in terms of Sand (%), Silt (%), Clay (%) & coarse fragments (%)
3. pH (standardized to a single specified method)
4. Depth to bedrock or restricting layer (m)

From these attributes, the following two properties will be predicted using pedo-transfer functions:

5. Bulk Density (kg/m^3)
6. Available Water Capacity (given in mm/m)

The project has identified the following secondary variables that are considered to be desirable and feasible to predict, but which are considered optional.

7. ECEC (Cations plus exchangeable acidity mol/kg)
8. EC (Electrical conductivity dS/m)

Values and uncertainty at specified depths.

A value will be predicted for each soil property, and for the uncertainty associated with this prediction, for each of the following six fixed depth increments. In addition a value will be predicted for each of total profile depth (depth to bedrock or consolidated material) and effective soil depth (depth to restricting layer).

No.	Depth Interval	Lower 2.5 Percentile of mean	Estimated Value of Soil Property	Upper 97.5 Percentile of mean
1	0 - 5 cm			
2	5 – 15 cm			
3	15 – 30 cm			
4	30 – 60 cm			
5	60-100 cm			
6	100-200 cm			
7	Effective depth		Effective Depth in m	
8	Total Profile Depth		Total Depth in m	

Georeferencing

The following georeferencing information will be recorded for each grid point location:

1. Projection: Geographic
2. Datum: WGS 84
3. Northing Coordinate: in decimal degrees
4. Easting Coordinate: in decimal degrees
5. Horizontal dimension in Y (North): in arc seconds
6. Horizontal dimension in X (East) in arc seconds
7. Date associated with the value estimate: dd/mm/yr

Nodes may elect to work in any suitable projection and datum that fits their needs, however, delivery of final predictions will follow the standards specified above. Individual nodes may elect to work using some kind of regular (e.g. Albers) Equal Area projection and perhaps even at different grid resolutions (e.g. 100 m x 100 m). These regular projected data sets will need to be converted to geographic coordinates, at a resolution of 3 x 3 arc-seconds, for delivery to, and inclusion in, the final *GlobalSoilMap.net* delivery product. Nodes will liaise with the Science Coordinator to ensure that all data delivered in geographic coordinates have coordinates that are equal multiples of 3 arc-seconds, starting at 0° latitude and 0° longitude.

Appendix A: Minimum data set for each 90 m grid cell location.

Appendix A provides an illustration of the minimum data set that will be required for each grid point location. This defines the expectations about what each node must be prepared to deliver to the global project for their geographic areas of responsibility. Nodes may elect to produce any other information of their choosing.

The prediction model (covariates and prediction technique used) used to make each prediction should be included with the final delivered data set. There is a need to identify, in the final deliverables, any conversion functions applied to any original value to harmonize or correlate it with other predicted values that exhibit systematic differences in value (e.g. need to be harmonized). Information on the origin of a soil sample (who sampled it) and method of lab measurement (how was it analysed) may also be reported as metadata associated with each soil property estimate. Such metadata is necessary for describing legacy soil data.

Appendix A: Illustration of a minimum data set for each 90 m grid cell location.

No.	Depth Interval	Value	OC g/kg	Sand %	Silt %	Clay %	CF (%)	pH	BD	AWC
		Projection								
		Datum								
		Northing								
		Easting								
		Effective Depth								
		Profile Depth								
		Origin of Sample								
		Analytical Method								
1	0 - 5 cm	Predicted value								
		Lower Uncertainty								
		Upper Uncertainty								
		Sample Date								
		Method Citation								
2	5 – 15 cm	Predicted value								
		Lower Uncertainty								
		Upper Uncertainty								
		Sample Date								
		Method Citation								
3	15-30 cm	Predicted value								
		Lower Uncertainty								
		Upper Uncertainty								
		Sample Date								
		Method Citation								
4	30-60 cm	Predicted value								
		Lower Uncertainty								
		Upper Uncertainty								
		Sample Date								
		Method Citation								
5	60-100 cm	Predicted value								
		Lower Uncertainty								
		Upper Uncertainty								
		Sample Date								
		Method Citation								
6	100-200 cm	Predicted value								
		Lower Uncertainty								
		Upper Uncertainty								
		Sample Date								
		Method Citation								
7	0-200 cm	Spline Smoothing Fn								