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Latin Hypercube Sampling (LHS) at variable resolutions for enhanced watershed scale Soil Sampling and Digital Soil Mapping.

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The Latin Hypercube Sampling (LHS) approach to assist with Digital Soil Mapping has been developed for some time now, however the purpose of this work was to complement LHS with use of multiple spatial resolutions of covariate datasets and variability in the range of sampling points produced. This allowed for specific sets of LHS points to be produced to fulfil the needs of various partners from multiple projects working in the Ontario and Prince Edward Island provinces of Canada. Secondary soil and environmental attributes are critical inputs that are required in the development of sampling points by LHS. These include a required Digital Elevation Model (DEM) and subsequent covariate datasets produced as a result of a Digital Terrain Analysis performed on the DEM. These additional covariates often include but are not limited to Topographic Wetness Index (TWI), Length-Slope (LS) Factor, and Slope which are continuous data. The range of specific points created in LHS included 50 – 200 depending on the size of the watershed and more importantly the number of soil types found within. The spatial resolution of covariates included within the work ranged from 5 – 30 m. The iterations within the LHS sampling were run at an optimal level so the LHS model provided a good spatial representation of the environmental attributes within the watershed. Also, additional covariates were included in the Latin Hypercube Sampling approach which is categorical in nature such as external Surficial Geology data.

Some initial results of the work include using a 1000 iteration variable within the LHS model. 1000 iterations was consistently a reasonable value used to produce sampling points that provided a good spatial representation of the environmental attributes. When working within the same spatial resolution for covariates, however only modifying the desired number of sampling points produced, the change of point location portrayed a strong geospatial relationship when using continuous data.

Access to agricultural fields and adjacent land uses is often “pinned” as the greatest deterrent to performing soil sampling for both soil survey and soil attribute validation work. The lack of access can be a result of poor road access and/or difficult geographical conditions to navigate for field work individuals. This seems a simple yet continuous issue to overcome for the scientific community and in particular, soils professionals.

The ability to assist with the ease of access to sampling points will be in the future a contribution to the Latin Hypercube Sampling (LHS) approach. By removing all locations in the initial instance from the DEM, the LHS model can be restricted to locations only with access from the adjacent road or trail. To further the approach, a road network geospatial dataset can be included within spatial Geographic Information Systems (GIS) applications to access already produced points using a shortest-distance network method.