CONDITIONAL HIERARCHICAL LINEAR MODELS IN SOIL SAMPLING SURVEYS

Adriana A. Gili[1], Elke J. Noellemeyer [2]and Mónica Balzarini[3]

[1] Conicet – Cátedra de Estadística y Diseño Experimental, Facultad de Agronomía, Universidad Nacional de La Pampa, La Pampa, Argentina.
[2] Cátedra de Edafología , Facultad de Agronomía, Universidad Nacional de La Pampa, La Pampa, Argentina.
[3] Conicet – Cátedra de Estadística y Biometría, Facultad de Ciencias Agropecuarias, Universidad Nacional de Córdoba, Córdoba, Argentina.

A common strategy in soil-vegetation studies would be to identify sampling sites in a large area and then randomly select sites and points within sites to be actually measured. Statistical models with hierarchical structure for two or more random effects allow accounting for the survey design. Moreover, when a classification variable with effects regarded as fixed which cluster the sampling points, the conditional hierarchical linear model (mixed model) is the recommended choice for statistical inference. In this work, we illustrate how to test mean differences of fixed effect factors in a soil science application involving a multiple-level nested sampling design, using mixed models. Levels of factors site, lot within site, transect within lot, and sampling point within transect were selected at random from the populations of possible levels. At each point, a pair of soil samples associated with sunny and shaded vegetal covertures was obtained and several soil features measured at two soil layers. Therefore, part of the point-to-point variance is described by classifying the levels according with a fixed effect factor representing the selected plant types. Our goal is to obtain information about random effects covariance parameters that better describe the data variation to adequately identify soil properties with significant changes between plant types. We compare hierarchical models by testing whether the additional covariance parameters are zero. We use SAS procedure GLIMMIX to run different approaches to test hypotheses on variance components (with small number of level for the random effects) and examine the results of least squares means comparisons for soil properties. These tests show that the variance components in the model are required to properly describe soil variations and detect plant type effects.