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基于样点个体代表性的大尺度土壤属性制图方法

Large-scaled soil attribute mapping method based on individual representativeness of sample sites

中文关键词:环境相似度 样点代表性 不确定性 土壤属性制图

Key words:Environmental similarity Sample representativeness Uncertainty Soil attribute mapping

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中文摘要:

大空间尺度范围的土壤属性分布信息是陆地表层过程模拟的基础信息。基于野外样点进行空间插值是获得土壤属性空间分布信息的重要手段。现有的空间插值方法通常要求所用样点对研究区土壤属性空间分布规律具有良好的全局代表性。然而，受采样经费和野外采样条件的限制，所采集的样点往往难以全面地反映研究区土壤属性的空间分布规律。基于这样的样点用现有空间插值方法得到的土壤属性分布图通常精度较低，并且由样点全局代表性差带来的推测不确定性也无法得到度量。为了合理利用这些已采集的但全局代表性不好的样点，本文提出了基于样点“个体代表性”推测土壤属性空间分布并度量推测不确定性的方法。该方法在两点环境条件越相似、土壤属性就越相似的假设下，认为每一样点可以代表与其环境条件相似的地区，并且代表程度可以由两点的环境相似度度量；通过分析环境相似度计算推测不确定性，并以环境相似度为权重计算样点可代表地区的土壤属性值。将该方法应用于推测新疆伊犁地区土壤表层有机质含量，经验证，本文方法能够有效地利用全局代表性差的样点推测样点能够代表地区的土壤属性空间分布，并且所得的推测不确定性与预测残差呈现正向关系，能够有效地指示推测结果的可靠程度。

英文摘要:

The information about spatial distribution of soil attributes over a large area is the basic one required for land surface process modeling. Spatial interpolation based on sampling sites in the field is an important way to acquire such information. The existing spatial interpolation methods usually call for sound representativeness of all the sampling sites for the whole study area in soil attribute spatial distribution. However, limited by budget and/or field accessibility for sampling, in most cases, the sampling sites chosen can hardly reflect comprehensively the spatial distribution of soil attributes of the study area. A soil attribute soil map worked out with the existing interpolation methods based on such sampling is often low in precision and the poor representativeness of the sampling makes it hard to measure the uncertainty it brings about in prediction. In order to make reasonable use of such samples and measure prediction uncertainty effectively, this paper presents a new method that uses the individual representativeness of each sample to predict soil attribute of unvisited locations and to quantify prediction uncertainty. Based on the assumption that the more similar the environment conditions of two sites, the more similar the soil attributes of the two, it is held that every sampling site can be used to represent an area similar to the site in environment, and the representativeness can be measured by similarity degree of the two. By analyzing environmental similarity, uncertainty in prediction can be measured, and with environmental similarity as weight, soil attribute values of the area a sampling site represents can be worked out. This method was once used to predict soil organic matter (SOM) content in the surface soil layer of the Yili District, Xinjiang Uyghur Autonomous Region for validation. As demonstrated, the method is an effective approach to using a sampling site that is poor in global representativeness to predict soil attribute spatial distribution of the area it represents, and the uncertainty of the prediction is positively related to the predicated residual, which can be used effectively to indicate credibility of the prediction.

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