水稻重金属污染胁迫光谱分析模型的区域应用与验证

Regional application and verification of spectral analysis model for assessing heavy-metal stress of rice

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中文摘要：

    根据样地试验建立的农作物重金属污染胁迫光谱分析模型通过卫星遥感数据进行大尺度区域应用是农作物重金属污染遥感评价必须解决的关键问题。该文以吉林长春市3块重金属污染程度不同的水稻农田样地为试验区，采集水稻冠层ASD（Analytical Spectral Devices）数据、叶片叶绿素含量和土壤重金属含量，并获取准同步的Hyperion数据，通过多元逐步回归分析筛选与重金属污染胁迫响应敏感的光谱指数，并运用BP人工神经网络模型构建其与表征重金属污染胁迫程度的叶绿素含量的数学关系模型。结果表明，样地水稻重金属污染胁迫光谱分析模型中的BP网络结构为4-11-7-1、传递函数为logsig，其对各类污染胁迫水平的判别精度均为100%；将所建立的样地水稻重金属污染胁迫光谱分析模型通过Hyperion影像，进行大面积推广并验证，得到其对各类污染胁迫水平的判别精度均超过80%。该研究为样地水稻重金属污染胁迫光谱分析模型的大面积推广应用提供了借鉴意义。

英文摘要：

    It is a key issue for identifying crops under heavy-metal contamination on a large scale using satellite remote sensing data based on ground-sample spectral analysis model for evaluating crops with heavy-metal stress level. In this paper, hyperspectral data and leaf chlorophyll concentration of rice, heavy-metal concentration of soil were collected from three different polluted paddies in Changchun city, Jilin province, China, at mean time, Hyperion data were obtained. Spectral indices sensitive to heavy-metal contamination were selected by multiple stepwise regressions, and BP neural network models were created to estimate chlorophyll concentrations in rice under heavy-metal stress, which indicated the level of heavy-metal contamination. It was founded that an optimum ground-sample spectral analysis model was 4-11-7-1 network architecture with logsig thansfer function, and the classification accuracy for each pollution level was 100%. Moreover, it was successful to apply the ground-sample spectral analysis model to Hyperion data, and then achieve large-scale application in monitoring rice under heavy-metal contamination, the classification accuracy for each pollution level was more than 80%. This research may provide important references for large-scale application in the spectral model for assessing rice under heavy-metal contamination.

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