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研究论文

额济纳荒漠绿洲植物群落的数量分类及其与地下水环境的关系分析

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摘要 为了科学地评价和预测生态输水对额济纳荒漠绿洲天然植被的影响, 亟需掌握额济纳荒漠绿洲的植物群落类型, 建立植被-环境因子的响应关系。该研究对额济纳荒漠绿洲的植物群落展开调查, 获取植物群落特征、分布状况及地下水环境数据, 应用双向指示种分析方法(TWINSPAN)对群落进行分类, 采用无偏对应分析(DCA)、无偏典范对应分析(DCCA)方法对群落进行排序, 得出额济纳荒漠绿洲主要植物群落类型, 以及影响植被类型变化和分布的地下水环境因子。研究结果表明: (1)采用TWINSPAN数量分类方法, 将植被划分为芦苇+杂类草(Ass. *Phragmites australis* + herbs)、胡杨-红柳+杂类草(Ass. *Populus euphratica-Tamarix ramosissima* + herbs)、沙枣-红柳+杂类草(Ass. *Elaeagnus angustifolia-Tamarix ramosissima* + herbs)、红柳-杂类草(Ass. *Tamarix ramosissima*-herbs)、花花柴-白刺+沙蒿+沙拐枣(Ass. *Karelinia caspica-Nitraria tangutorum* + *Artemisia* sp. + *Calligonum* sp.)、麻黄-红砂+白刺+骆驼刺(*Ephedra przewalskii-Reaumuria soongorica* + *Nitraria tangutorum* + *Alhagi sparsifolia*)等6个主要植物群丛; (2)对于额济纳荒漠绿洲这一特定的研究区域, 制约群落类型、植被分布格局的主要地下水因子为地下水埋深; (3)对群落产生显著影响的地下水环境因子主要有地下水埋深、pH、盐分、矿化度、电导率、HCO_3^- 等6个变量。DCCA排序图明显反映出排序轴的生态意义, 第1轴突出反映了群落所在环境的地下水埋深, 沿第1轴从右到左, 地下水埋深逐渐增大, 群落的盐分及矿化度亦呈明显的增加趋势, 群丛依次从类型I到VI逐渐演变。额济纳三角洲作为干旱区的荒漠绿洲, 有着明显的特点: 植物群落组成的生物多样性趋于贫乏化和单一化, 生态结构简单, 植被稀疏, 种类单一, 群落覆盖度较低, 群落格局分异明显。地下水埋深变化是群落物种及类型变化的主要原因。

关键词:　无偏典范对应分析　无偏对应分析　额济纳荒漠绿洲　地下水环境　植物群落　双向指示种分析

Abstract：　*Aims* Ejin Desert Oasis is a typical arid oasis in the Hexi corridor of northwestern and northern China. Water resources in the area have changed since 2000. Our objective was to classify the plant community types and determine the relationship between vegetation and environmental factors in order to evaluate the influence of water regulation on vegetation in this region.
Methods We obtained data on 29 plant species from 151 study plots of natural vegetation of the Ejin Desert Oasis and classified the plant communities by two-way indicators species analysis (TWINSPAN) and correlated them with six groundwater environmental variables using detrended correspondence analysis (DCA) and detrended canonical correspondence analysis (DCCA) ordinations.
Important findings Six plant associations were identified. The main factor correlated to their distribution was groundwater depth, which had more influence on the distribution of plant species and vegetation than other variables because change of groundwater depth leads to changes in both salinity and mineralization. The first ordination axis was correlated with the gradient of groundwater depth, and the second axis was correlated with pH. Compared with other areas, the scarcity of plant species and the differentiation of plant communities were obvious.

Keywords：　detrended canonical correspondence analysis,　detrended correspondence analysis,　Ejin Desert Oasis,　groundwater environment,　plant community,　two-way indicators species analysis

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