生态学报 Acta Ecologica Sinica

首页 | 关于本刊 | 影响因子及获奖 | 投稿须知 | 订阅指南 | 广告业务 | 学术会议 | 专辑与专题 | 优秀论文

任学敏,杨改河,王得祥,秦晓威,刘振学,赵双喜,白宇.环境因子对巴山冷杉-糙皮桦混交林物种分布及多样性的影响.生态学报,2012,32(2):605~613

# 环境因子对巴山冷杉-糙皮桦混交林物种分布及多样性的影响

# Effects of environmental factors on species distribution and diversity in an *Abies fargesii-Betula utilis* mixed forest

投稿时间：2010-11-29 最后修改时间：2011-4-7

DOI：10.5846/stxb201011291695

**中文关键词**: 物种分布 CCA 环境因子 物种多样性 GAM 巴山冷杉-糙皮桦混交林

English Keywords:species distribution CCA environmental factors species diversity GAM *Abies fargesii-Betula utilis* mixed forest

**基金项目**:科技基础性专项重点项目(2007FY110800);林业公益性行业专项(200804022B);国家自然科学基金资助项目(31070570)

| 作者 | 单位 | E-mail |
|---|---|---|
| 任学敏 | 西北农林科技大学农学院, 杨凌 712100;陕西省循环农业工程技术研究中心, 杨凌 712100 | |
| 杨改河 | 西北农林科技大学农学院, 杨凌 712100;陕西省循环农业工程技术研究中心, 杨凌 712100 | ygh@nwsuaf.edu.cn |
| 王得祥 | 西北农林科技大学林学院, 杨凌 712100 | |
| 秦晓威 | 西北农林科技大学农学院, 杨凌 712100;陕西省循环农业工程技术研究中心, 杨凌 712100 | |
| 刘振学 | 陕西省循环农业工程技术研究中心, 杨凌 712100;西北农林科技大学林学院, 杨凌 712100 | |
| 赵双喜 | 陕西省循环农业工程技术研究中心, 杨凌 712100;西北农林科技大学林学院, 杨凌 712100 | |
| 白宇 | 西北农林科技大学农学院, 杨凌 712100;陕西省循环农业工程技术研究中心, 杨凌 712100 | |



**中文摘要**:

对太白山巴山冷杉(*Abies fargesii*)-糙皮桦(*Betula utilis*)混交林及其环境因子进行了调查,采用CCA排序法分析了环境因子与物种分布的关系,偏CCA评估了各个环境因子的重要程度,GAM拟合了物种丰富度对各个环境因子的响应。结果显示,土壤pH、海拔、岩石盖度对物种分布有显著影响($P < 0.05$),其影响强度为:海拔>岩石盖度>pH,其它环境因子(土壤有机质、全N、全P含量和坡度)影响不显著($P > 0.05$)。GAM拟合结果表明,土壤pH、岩石盖度、海拔和全N含量是影响物种丰富度的主要环境因子($P < 0.01$),物种丰富度随pH值升高而增加,随岩石盖度和海拔升高而减小,而随全N含量的变化较为复杂;土壤有机质、全P含量和坡度对物种丰富度没有显著影响($P > 0.05$)。巴山冷杉-糙皮桦混交林物种分布及多样性是由海拔、岩石盖度和土壤pH值为主的多种环境因子综合作用的结果。

English Summary:

Environmental factors have a full impact on species distribution and diversity of forest community. The relationship between environmental factors and species patterns suggests important implications for developing optimal strategies for conservation of species diversity, sustainable managing and utilizing plant resources. Various types of plant communities have been documented in regard to the relationship of environmental factors to species distribution and diversity; however, little attention has been paid to *Abies fargesii-Betula utilis* mixed forest, the typical plant community functioning critically in soil and water conservation. We investigated characteristics and environmental factors of the *Abies fargesii-Betula utilis* mixed forest located within an elevation of 2700-3100 m in Taibai Mountain, China from July through September 2009 and July through August 2010. We established 3 transects along elevation gradient, and set up 10 plots (20m×20m, for trees) in each transect. In the corner of each plot, we set up one subplot (10m×10m) for shrubs and herb. We recorded the community characteristics including species name, number, cover, height, tree basal diameter and diameter at breast height (*DBH*>1cm) as well as the environmental factors including elevation, slope, stone cover, soil pH, organic matter, total nitrogen and total phosphorus. Three analysis procedures were carried out: canonical correspondence analysis (CCA) to examine relationship between species distribution and environmental factors, partial CCA to assess the respective importance of environmental factors on species distribution, and generalized additive model (GAM) to fit response of species richness to various environmental factors. The results showed that soil pH, elevation and stone cover had significant effect on species distribution ($P < 0.05$) with the impact intensity being elevation > stone cover > pH. Nevertheless, the other environmental factors (soil organic matter, total nitrogen, total phosphorus content and slope) had no significant effect ($P > 0.05$). Some species, such as *Ribes glaciale*, *Lonicera webbiana*, *Rubus amabilis, Chrysosplenium pilosum* var. *valdepilosum*, and *Kobresia myosuroides*, were associated with low stone cover, acidic and total phosphorus poor-soil; otherwise, *Betula utilis*, *Sabina pingii* var. *wilsonii*, *Potentilla glabra*, *Ajuga ciliate* and *Ajania variifolia* were more prominent in high stone cover, low acidic and total phosphorus rich-soil. Besides, *Spiraea mongolica*, *Pleurospermum heterosciadium*, *Carex filamentosa*, *Poa nemoralis* and *Draba ladyginii* var. *trichocarpa* occurred at a high elevation. However, *Lonicera szechuanica*, *Rubus pileatus, Fragaria gracilis*, *Viola biflora* and *Carex capilliformis* var. *major* were found in all plots since all environmental factors had little effects on their distribution. GAM analysis indicated that the major environmental factors associated with species richness were soil pH, stone cover, elevation and total nitrogen content ($P < 0.01$). Species richness increased with increasing pH and decreasing stone cover and elevation, and richness changed intricately with changes of total nitrogen content; in contrast, there were no significant effects on species richness ($P > 0.05$) from soil organic matter, total phosphorus content and slope. Thus, species distribution and richness pattern of *Abies fargesii-Betula utilis* mixed forest were influenced by a variety of environmental factors in which elevation, stone cover and soil pH played the most important role.

地址:北京海淀区双清路18号 邮编:100085 电话:010-62941099 E-mail : shengtaixuebao@rcees.ac.cn