

内蒙古大兴安岭东部林下植物生物多样性海拔差异研究

史恭发¹, 徐诺¹, 牛钊倩¹, 孙炜伦¹, 王好¹, 石广振¹, 王玲^{1*}

(1 东北林业大学园林学院, 哈尔滨 150040)

摘要: 海拔影响生物多样性分异, 为探究寒温带山岭地区海拔对林下植物多样性分布影响, 选择内蒙古大兴安岭东部地区, 采用样地调研法, 设置 E1 (200—350 m), E2 (350—500 m), E3 (500—650 m), E4: (650—800 m), E5: (800—950 m), E6 (950—1100 m) 6 个不同海拔梯度, 调研 165 个林地样点以了解不同海拔森林群落物种组成, 研究林下植物生物多样性海拔差异性、地形因素、乔木层优势物种与林下植物生物多样性的相关性。研究得出: (1) 调研区林下植物共 277 种隶属于 53 科 135 属, 灌木 32 种、草本 245 种; 按功能划分为药用植物 149 种、观赏植物 96 种、野菜植物 23 种、野果植物 15 种、蜜源植物 8 种、芳香植物 4 种、纤维植物 3 种、油脂植物 3 种、农药植物 2 种、淀粉植物 1 种。(2) 森林乔灌群落随海拔依次为蒙古栎-黑桦-榛-胡枝子群落 (E1—E2)、落叶松-白桦-榛-胡枝子群落 (E3)、落叶松-白桦-欧亚绣线菊-绣线菊群落 (E4)、落叶松-白桦-兴安杜鹃-越橘群落 (E5)、落叶松-白桦-越橘-偃松群落 (E6); (3) 林下植物物种多样性随海拔上升呈现明显的单峰格局。生物多样性草本层>灌木层, 灌木层随海拔升高呈上升趋势, 草本层呈先下降后升高的波动下降趋势; (4) 草本层物种替换速率远高于灌木层, E3—E4 与 E2—E3 梯度内灌木层与草本层物种替换速率分别达到峰值; 灌木层与草本层相邻海拔梯度间相似度指数均呈先下降后升高再下降的波动形式; (5) 地理因素及优势乔木种不同能够显著影响林下植物 α 多样性, 灌木层 α 多样性与海拔、纬度呈正相关, 与经度、坡度呈负相关。草本层与海拔呈负相关, 与纬度、坡向呈正相关, 海拔对草本层 α 多样性影响高于灌木层。郁闭度与灌木层 α 多样性呈正相关, 与草本层 α 多样性呈负相关; 落叶松增多可提升灌木层生物多样性, 黑桦会降低灌木层物种丰富度, 而山杨会降低草本层物种分布的均匀度。研究结果为保护与利用内蒙古大兴安岭林下植物, 丰富寒温带山岭地区植物多样性海拔分布理论提供科学依据。

Altitudinal differences of understory plant biodiversity in eastern Greater Xing'an Mountains, Inner Mongolia

Gong-Fa Shi¹ Nuo Xu¹ Zhao-Qian Niu¹ Wei-Lun Sun¹ Hao Wang¹ Guang-Zhen Shi¹ Ling Wang^{1*}

(College of Landscape Architecture, Northeast Forestry University, Harbin 150040, China)

Abstract: In order to explore the effect of altitude on the diversity of undergrowth plants in the cold temperate mountain area, we selected the eastern Greater Xing'an Mountains in Inner Mongolia by using the plot investigation method, and set six different altitude gradients: E1 (200—350 m), E2 (350—500 m), E3 (500—650 m), E4 (650—800 m), E5 (800—950 m), and E6 (950—1100 m). We investigated 165 forest sites to understand the composition

of forest communities at different altitudes, and studied the relationship between the altitude difference in understory plant biodiversity, topographic factors, and dominant species in the arboreal layer and understory plant biodiversity. The results showed that: (1) there were 277 understory plant species belonging to 53 families and 135 genera, including 32 shrubs and 245 herbs. (2) The forest tree and shrub communities with different altitudes were in the order of *Quercus Mongolia*, *Betula daturic*, *Corylus heterophylla*, *Lespedeza bicolor* communities (E1—E2), *Larix gmelina*, *Betula platyphylline*, *Corylus heterophylla*, *Lespedeza bicolor* communities (E3), *Larix gmelina*, *Betula platyphylline*, *Spiraea media*, *Spiraea silicified* communities (E4), *Larix gmelina*, *Betula platyphylla*, *Rhododendron dauricum*, *Vaccinium vitis-idaea* communities (E5), *Larix gmelinii*, *Betula platyphylla*, *Vaccinium vitis-idaea*, *Pinus pumila* communities (E6). (3) The diversity of understory plant species showed an obviously unimodal pattern with the increases of altitude. The herb layer was higher than the shrub layer. The shrub layer showed an increasing trend with the increasing altitude, while the herb layer showed a fluctuating decrease trend of first decreasing and then increasing. (4) The replacement rate of species in herbaceous layer was much higher than that in shrub layer, with the replacement rate in shrub and herbaceous layer peaking in E3—E4 and E2—E3 gradients, respectively. The similarity index between shrub layer and herbage layer decreased first, then increased, and finally decreased. (5) The geographical factors and different dominant tree species could significantly affect the α diversity of understory plants. The α diversity of shrub layer was positively correlated with altitude and latitude, and negatively correlated with longitude and slope. The herbaceous layer was negatively correlated with altitude, but positively correlated with latitude and slope aspect. The effect of altitude on α diversity of herbaceous layer was higher than that of shrub layer. The canopy density was positively correlated with the α diversity of shrub layer and negatively correlated with the α diversity of herb layer. *Larix gmelinii* increased biodiversity in shrub layer, *Betula dahurica* decreased species richness in shrub layer, and *Betula dahurica* decreased species distribution evenness in herbaceous layer. Our results provided scientific basis for the protection and utilization of undergrowth plants in the Greater Xing'an Mountains and the theory of altitudinal distribution of plant diversity in the cold temperate mountains.