氮沉降对亚热带森林倒木分解主场效应的影响

吴春生[1*]，王 波[1]，侯杰希[1]，刘苑秋[2]

（1. 南昌工程学院水利与生态工程学院 南昌 330099；2. 江西农业大学林学院 南昌 330045）

摘 要：【目的】氮（N）可以通过改变微生物和动物群落的丰度和活性来影响森林生态系统的功能。氮沉降对倒木分解的主场优势（HFA）效应的影响尚不清楚。【方法】在本研究中，在氮沉积量位居世界前列的中国亚热带地区，设置三个不同水平的氮沉降处理（对照（N0）、60（N1）和 120（N2）kg N ha^{-1} yr^{-1}），进行了为期 24 个月的野外倒木木材交互迁移实验。使用不同尺寸的网袋划分土壤生物群对倒木分解 HFA 效应的影响。【结果】我们发现 N1 处理通过提高倒木木材动物和微生物群落的丰度以及土壤胞外酶活性来促进倒木分解。然而，N2 在粗网袋中通过吸引更多动物来促进倒木分解，在细网袋中则通过增加真菌生长来促进倒木降解。在对照（CK）处理中，我们发现细网袋中的 HFA 效应是粗网袋的 4.55 倍。平均而言，N1 处理的 HFA 效应分别是 N2 和对照处理的 6.6 倍和 4.8 倍，这些差异与主场和客场之间微生物和动物群落的更大差异有关。【结论】总之，我们的结果表明，低水平的人为氮添加可以通过改变倒木分解过程中的微生物和动物群落来增加 HFA 效应对倒木分解的影响，从而影响亚热带地区的森林在未来几十年碳的固存，进而影响我国森林在双碳中的功能发挥。

关键词：倒木，主场效应，土壤动物群落，植物-土壤交互作用，氮沉降

Effect of N deposition on the home-field advantage of wood decomposition in a subtropical forest

Abstract:【Objective】Nitrogen (N) can influence the functions of forest ecosystems by altering the abundance and activity of microbial and faunal communities. The impact of N deposition on the home-field advantage (HFA) effect of dead wood decomposition remains unclear.【Method】In this study, a 24-month field reciprocal wood translocation experiment was conducted with three levels of N deposition (control (N0), 60 (N1) and 120 (N2) kg N ha^{-1} yr^{-1}) in both *Platycarya strobilacea* (PL) forest and *Cryptomeria japonica* (CR) forest in subtropical China, where anthropogenic N deposition is among the highest in the world. The influence of soil biota groups on the HFA effect was partitioned using different sizes of mesh bags. 【Result】 We found that N1 facilitated wood decomposition by enhancing wood faunal and microbial community abundance and soil extracellular enzyme activity. However, N2 promoted wood decomposition in coarse-mesh bags by attracting more fauna and in fine-mesh bags by increasing fungal growth. In the control (CK) treatments, we found a 4.55-fold greater HFA effect in fine-mesh bags than in coarse-mesh bags. On average, a 6.6- and 4.8-fold greater HFA effect was observed with N1 treatment than with N2 and control treatments, respectively, and these differences were associated with greater differences in microbial and faunal communities between home and away fields.【Conclusion】In summary, our results indicated that low levels of anthropogenic N enrichment could increase the HFA effect on wood decomposition through the modification of microbial and faunal communities in the wood decomposition process and thereby influence C sequestration, with peak carbon emissions and carbon neutrality reached in the next few decades in the forests of subtropical regions.

Keywords: Wood; HFA; Soil fauna groups; Plant-soil interactions; Microbial community; N deposition

基金项目：国家自然科学基金项目（3190129；31460185）；江西省自然科学基金面上和青年项目（20224BAB203051 和 20212BAB213022）。

*吴春生为通讯作者