

研究论文

中亚热带红壤区油桐 (*Vernicia fordii*) 林冠水文效应特征

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摘要 于从2004年7月到2005年9月, 对南方红壤区油桐人工林的穿透雨、树干流和林冠截留的水文特征进行了监测, 并对其影响因素进行初步分析, 结果表明: 在整个测定期间, 油桐林穿透雨占总降雨量 $75.6\% \pm 8.6\%$, 树干流占 $3.6\% \pm 1.1\%$, 而截留量占 $20.8\% \pm 9.1\%$ 。油桐林冠对降雨的再分配受到降雨量和降雨强度的影响, 随着降雨量的增加, 穿透雨、树干流和截留量相应地提高, 并且树干流和截留量在高的雨量下逐渐趋于稳定; 随着降雨强度的增加, 穿透雨率逐渐升高, 而树干流率和截留率降低。在不同雨量级间, 油桐穿透雨具有显著性的差异, 但树干流的差异不显著。油桐林下水分输入存在明显的空间异质性, 穿透雨在不同观测点间具有显著性差异, 靠近树干的林冠内部穿透雨低于林冠边缘, 而且随着降雨量或降雨强度的增加, 穿透雨的空间异质性(穿透雨率的变异系数CV)降低; 树干流对降雨也具有明显的汇集作用, 在树干周围输入的雨量是林外降雨量20~70倍, 并且随着降雨量的增加, 这种汇集效应(漏斗比率)先提高后降低。同时油桐单株树干流($\text{cm}^3 \cdot \text{mm}^{-1}$)与胸径、树高和冠层面积均呈显著正相关($p < 0.05$), 但是与枝下高的相关性不显著($p > 0.05$)。

关键词 降雨再分配; 穿透雨; 树干流; 水文效应; 漏斗比率; 南方红壤区

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Hydrological characteristics of *Vernicia fordii* canopy in red soil region of mid-subtropics

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Abstract Rainfall redistribution is an important hydrological process in forest ecosystems. The partitioning of gross rainfall into throughfall, stemflow and interception in the *Vernicia fordii* forest was studied from July 2004 to September 2005 at the Ecological Benefit Monitoring Station of the Yangtze River Protection Forest in Cili County, Hunan Province. During the measurement period, throughfall, stemflow and interception expressed percentage of gross rainfall in the *V. fordii* forest were $75.6\% \pm 8.6\%$, $3.6\% \pm 1.1\%$ and $20.8\% \pm 9.1\%$ respectively. Rainfall redistribution in *V. fordii* was closely related with rainfall depth or rainfall intensity. As rainfall increased, throughfall, stemflow and interception (mm) increased. However, stemflow and interception stabilized at the larger rainfall depth. As rainfall intensity increased, throughfall percentage (%) increased, while stemflow percentage (%) and interception percentage (%) decreased. Differences in throughfall (%) were significant among different rainfall classes. However, no significant difference was found in stemflow between different rainfall classes. Water input below the canopy had clearly spatial heterogeneity. Throughfall differed significantly ($p < 0.05$) among different sampling sites and throughfall pe

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percentage close to the tree was significantly lower than those under the peripheral part. The spatial variation in throughfall (i.e., CV of throughfall percentage) decreased with increasing rainfall depth or rainfall intensity. Stemflow in *V.fordii* can obviously concentrate water into a small area around the tree trunk, which was 20-70 times higher than rainfall depth during the same period. With increasing rainfall, the funneling ratio (FR) showed the tendency of a first increase and consequent decrease. Stemflow amount ($\text{cm}^3 \cdot \text{mm}^{-1}$) in *V.fordii* showed significantly positive correlation with structural characteristics of the forest such as diameter at breast height, tree height and crown area. No significant correlation was found between stemflow and height from the base to the first branch.

Key words [rainfall](#) [redistribution](#) [throughfall](#) [stemflow](#) [forest](#) [hydrology](#) [funneling ratio](#) [red soil region](#)

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