不同经营方式马尾松人工林土壤截持降水能力及调控因素

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摘 要:【目的】明确区域尺度上不同经营方式人工林的土壤截持降水能力及其驱动因素对人工林管理及水土保持至关重要。【方法】在中国亚热带地区（广东肇庆、湖南会同和湖北秭归），基于氢稳定同位素技术探讨了不同量级降水（小雨、中雨和大雨）对不同经营方式马尾松人工林（纯林、混交林、除灌林、轻度间伐林及重度间伐林）土壤水的贡献率。进一步地，我们基于方差分解和结构方程模型等方法揭示了影响降水对土壤水贡献率（CRSW）的主要因素。【结果】不同降水条件下，各经营方式马尾松人工林的 CRSW 明显不同。小雨时，重度间伐林 CRSW 最高（28.70%）。与之相反，大雨时重度间伐林 CRSW 显著低于其他四种经营方式（43.29%），而针阔混交林 CRSW 显著高于其他经营方式（67.14%）。进一步研究发现，小雨时，影响马尾松林 CRSW 的主要因素为植物属性，而中、大雨时影响马尾松林 CRSW 的主要影响因素是土壤属性。【结论】马尾松针阔混交林的水土保持能力更强，而重度间伐马尾松林的水土保持能力较差，故未来在中国亚热带地区营造或修复马尾松人工林时，应注重混交林营造，同时避免重度砍伐，这有利于提高人工林的截持强降水能力，保持水土。此外，影响马尾松林土壤截持降水能力的主导因素随降水量变化而改变，因此在探讨 CRSW 的主导因素时不能简单归因于植物属性或土壤属性，而应考虑降水量大小。

关键词：不同经营方式；马尾松人工林；氢同位素；中国亚热带

Soil Interception Capacity of Pinus massoniana Plantation with Different Management Modes and Its Controlling Factors

Absrtact:【Objective】It is very important for plantation management and soil and water conservation to make clear the soil interception and precipitation capacity and its driving factors of plantations with different management modes on regional scale.【Method】Based on the hydrogen stable isotope technique, the contribution rates of precipitation of different magnitude (light rain, moderate rain and heavy rain) to soil water of Pinus massoniana plantations with different management modes (pure forest, mixed forest, except shrub forest, light thinning forest and heavy thinning forest) were discussed in the subtropical areas of China. Furthermore, based on variance decomposition and structural equation model, we reveal the main factors that affect the contribution rate of precipitation to soil water (CRSW).【**Result**】Under different precipitation conditions, the CRSW of Pinus massoniana plantation in different management modes is obviously different. In light rain, the CRSW of severe thinning forest is the highest (28.70%). On the contrary, the CRSW of heavy thinning forest was significantly lower than that of other four management modes (43.29%), while the CRSW of coniferous and broadleaved mixed forest was significantly higher than that of other management modes (67.14%). Further research found that the main factor affecting the CRSW of Pinus massoniana forest was the plant property in light rain, while the main factor affecting the CRSW of Pinus massoniana forest in moderate and heavy rain was the soil property.【**Conclusion**】The soil and water conservation ability of Pinus massoniana mixed forest is stronger than that of heavily thinning Pinus massoniana forest. Therefore, when constructing or restoring Pinus massoniana plantation in subtropical areas of China in the future, we should pay attention to the construction of mixed forest and avoid heavy logging, which will help to improve the ability of intercepting heavy rainfall and maintain soil and water. In addition, the dominant factors affecting the soil interception ability of Pinus massoniana forest change with the change of precipitation, so the dominant factors of CRSW should not be simply attributed to plant properties or soil properties, but should consider the magnitude of precipitation.

Keywords:different modes of operation; Pinus massoniana plantation; Hydrogen isotope; Subtropical China

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