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Data Article

Experimental data on the adsorption of water by branches and leaves as affected by different the morphological characteristics of plants

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ABSTRACT

We determined 116 globally important woody tree species, classified them based on the differences between plant life-forms, leaf textures and trichomes on leaves and measured the indices of some plant morphological traits in the Guizhou karstic regions of China. The water adsorbed on the upper surfaces of branches and leaves and the water adsorbed on the upper and lower surfaces of branches and leaves (WW_u and WW_{ul}) of these species was measured. The ratios of the weight of adsorbed water on the upper surfaces of branches and leaves to the weight of branches and leaves (RWW_u) and the ratios of the weight of adsorbed water on the upper and lower surfaces of branches and leaves to the weight of branches and leaves (RWW_{ul}) were calculated. The adsorption of water and morphological trait indices follow the approximately normal distributions. The weight of branches and leaves (weight), total leaf area (TLA) and mean leaf area (MLA) significantly impacted the adsorption of water by branches and leaves. The different rates of the adsorption of water for 116 tree species can explain the interspecific

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variation in rainfall interception. Interpretation of these data is provided in Effects of the morphological characteristics of plants on rainfall interception and kinetic energy[J]. Journal of Hydrology, 2020: 125807. https://doi.org/10.1016/j.jhydrol.2020.125807.

Specifications Table

Subject area	Eco-hydrology
Specific subject area	Effects of the morphological characteristics of plants on rainfall interception
Type of data	Table Supplemental Excel
How data were acquired	Hardware: Laser leaf area meter (CI-203, CID Bio-Science, Inc., USA); rainfall simulator. Software: Excel
Data format	The data file in word and excel (.csv) format has been uploaded.
Parameters for data collection	Weight of the adsorption of water by branches and leaves for each tree species, weight of branches and leaves (weight), total leaf area (TLA), mean leaf area (MLA) and leaf shape factor (LSF).
Description of data collection	1. Plant morphological characteristics were recorded according to botanical traits and measured by laser leaf area meter. 2. The adsorption of water by branches and leaves were tested by weight method. 3. The distributions of data for different tested indices were recorded with EXCEL.
Data source location	Institution: Chang'an University City/Town/Region: Xi'an Country: China Latitude and longitude (and GPS coordinates) for collected samples/data: 106°40'00' E, 26°25'38' N
Data accessibility	With the article
Related research article	Yan T, Wang Z, Liao C, et al. Effects of the morphological characteristics of plants on rainfall interception and kinetic energy[J]. Journal of Hydrology, 2020: 125807. https://doi.org/10.1016/j.jhydrol.2020.125807

Value of the Data

- The data revealed the interspecific differences of the adsorption of water by branches and leaves for 116 important species.
- These data are useful because they provide morphological characteristics for 116 globally important woody tree species in Karst region.
- All researchers and readers who focus on vegetation ecology can benefit from these data.
- The data can be useful to identify the different plant species applied to control soil erosion in ecological engineering.
- The data could enrich the readers' knowledge about the botanical mechanisms within individual level.

1. Data Description

The data describes the adsorption of water on branches and leaves and different plant characteristics among 116 important woody species in the central Guizhou province of China. The region is the largest karst ecosystem in the world [1]. In supplemental file 1 of related research article, the qualitative records of plant life-form, leaf texture, trichomes on leaves for 116 tree species are given. These species include 67 evergreen plants and 49 deciduous plants, 49 paper leaves and 64 leathery leaves, and 31 species with trichomes and 82 without trichomes. The weight of branches and leaves (g), mean leaf area (cm^2), total leaf area (cm^2), leaf shape factor, branch length (cm) and leaf length (cm) are showed for 116 tree species in supplement. The weight of adsorbed water on branches and the upper surface of leaves (WW_u, g), the weight of adsorbed water on branches and the upper and lower surfaces of leaves (WW_{ul}, g), the ratios of the weight of adsorbed water on the upper surfaces of branches and leaves to the weight of branches and leaves (RWW_u, %), and the ratios of the weight of adsorbed water on the upper and lower surfaces of branches and leaves to the weight of branches and leaves (RWW_{ul}, %) for 116 tree species are shown in the Supplementary File attached to this submission.

2. Experimental Design, Materials and Methods

2.1. Experimental Design and Methods

The popular method for determining rainfall interception is spiral groove technology [2,3]. However, this method cannot be used on a large number of plants, including small bush and herbs in a forest, and it cannot deeply understand the influence of the surface microscopic characteristics of species on rainfall interception. Therefore, we tested the adsorption of water by branches and leaves to explain rainfall interception. The adsorption of water by branches and leaves is comprised of the water films and water drops adhering to the branches and leaves in a tree canopy when rainwater falls onto the tree canopy [4,5]. The water on the branches and leaves can change into throughfall and stemflow, but the relatively stable section on the branches and leaves is considered rainfall interception [6]. We selected seven sites (Guiyang City (including Huaxi District, Qianlin Park and Guizhou university), Sandu Country, Dushan Country, Duyun City and Libo Country) to measure indicators and collect samples. We successively searched 2-4 sample trees of each species at the first site, based on average diameter at breast height of each species, according to the data from a previous vegetation survey. If the sample tree of a target species at the first site was not found, we would continue to search at another site until all species were found. All sample trees were required to have a complete canopy and to be growing well, without artificial destruction, pests or disease. We sampled five standard branches (five replicates) with leaves from the different sections of the tree canopy for each of the sample trees. The basal diameters of the sampled branches for all tree species were determined to be one centimeter because most of the leaves in different tree species mainly grow on the branches the diameters of which are generally about one centimeter according to our investigation [5]. The diameters of the second or third order of branches on each standard branch, some plants had but other plants could not, had not been unified in sampling, which was considered as interspecific differences in botanical characteristics. We tried to sample similarly sized and aged branches from different tree species, based on visual detection and branching. We recorded the plant morphological characteristics of the for these samples (number of branches, leaf length, branches length, etc.). Leaf length and branches length are measured by stretching the samples. All these data were recorded in supplemental excel. Laser leaf area meter (CI-203, CID Bio-Science, Inc., USA) was used to measure MLA and LSF (Supplemental Excel). LSF is calculated by Equation 1, which is equal to one for a circular leaf [2].

$$f = 4\pi \frac{a}{P^2} \tag{1}$$

where f is leaf shape factor, a is leaf area (m^2) and P is perimeter (m).

Then, each branch was fixed in the device for the test of the adsorbed water and weighed. The manner of stretching of the branch in the device was similar to that in a tree canopy. Tap water was used as rainfall to spray the surface of each branch for three minutes, with a sprayer placed above the device. The volume of spraying water was equal to 150 mm rainfall so that the surface of a sampled branch and the leaves on which were completely wetted during a short time. Then testing the approximate value of the maximum rainfall interception of the branch and leaves. The completely wet branch was weighed when no water dripped from the branch after one minute. WW_u was one result obtained when we did not rotate the knob linking the branch at the right of the device. Under the circumstance, the sprays primarily touched the upper surfaces of a branch and the leaves on the branch. After weighing, we obtained the data of the weight of adsorbed water on the upper surfaces of a branch and the leaves on the branch. The goal of the experiment was to test adsorbed water under the conditions of no wind blowing branches and leaves to flip them up and raindrops only falling on the upper surfaces of branches and leaves during a rain event. Subsequently, we rotated the knob linking the branch at the right of the device, and caused the branch to rotate 1080 degrees (i.e., three circles) when we sprayed water to the branch for three minutes. The rotation caused both the upper and lower surfaces of a branch and the leaves on the branch to touch sprays. Therefore, water was adsorbed on both the upper and lower surfaces of branch and leaves. Then, when no water dripped from the branch and leaves for about one minute, we began to weigh the wet branch with leaves and obtained WW_{ul}. WW_{ul} was one result obtained when we rotate the knob linking the branch at the right of the device. Five repeated experiments were conducted on the water adsorption rate of each plant. WW_u and WW_{ul} for each species were calculated using Equation 2 (see in the Supplemental Excel).

$$\text{WWu or WWul} = \text{Weight of sample after spraying water g} \\ -\text{Weight of sample without spraying water (g)} \tag{2}$$

Then, we calculated RWW_u and RWW_{ul} for each species (eq.3). Meanwhile, we counted the number of leaves on the standard branches of 116 tree species (which were used to test RWW_u and RWW_{ul}) and calculated the total leaf area (TLA) of each standard branch by multiplying MLA and the number of leaves (See in the Supplemental Excel).

$$\text{RWW}_\text{u}\text{or RWW}_\text{ul}(\%) = \frac{(WWu\ or\ WWul) \times 100}{\text{Weight of sample without spraying water (g)}} \tag{3}$$

2.2. Experimental Materials

116 tree species with an important role in structuring the karst evergreen broadleaf forests in this region and seven forest sites for measuring the adsorption of water by branches and leaves were selected. 2-4 sample trees were determined for each species at one site [7]. If the sample tree of a target species at the first site was not found, we would continue to search at the following site until all species were found. All sample trees were required to have a complete canopy and to be growing well, without artificial destruction, pests or disease. Five standard branches (five replicates) with leaves from the different sections of the tree canopy for each of the sample trees. The basal diameters of the sampled branches for all tree species were determined to be one centimeter because most of the leaves in different tree species mainly grow on the branches the diameters of which are generally about one centimeter according to our investigation [5]. (Supplemental Excel)

CRediT Author Statement

Ting Yan: Methodology, Data curation, Writing-original draft, Visualization. **Zhenhong Wang:** Conceptualization, Methodology, Supervision, Funding acquisition, Investigation. **Chonggang Liao:** Investigation. **Wanying Xu:** Investigation. **Li Wan:** Investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have perceived to influence the work reported in this paper.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2020.106689.

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