Journal of Global Change Data & Discovery. 2020, 4(4): 380-386
DOI:10.3974/geodp.2020.04.09
www.geodoi.ac.cn


Global Change Research Data Publishing & Repository

# *In Situ* Soil Moisture Datasets in Zhonggou and Zhifanggou Watershed of Longdong Loess Plateau (2017–2019)

Zhang, L. Y.[1] Di, L.[1*] Wu, X. Z.[2*] Zhang, J.[1] Wang, A. M.[3] Ru, H. L.[3] Ni. F.[1] Zhao, Z. L.[1] Zhang, R. F.[4] Wu, L.[1] Li, H. Q.[1] Su, X. L.[5] Liu, J. J.[6] Zhao, B. Z.[1] Yang，T[1]

1. College of Resources and Environmental Sciences, Gansu Agricultural University, Lanzhou 730070; China;
2. College of Earth and Environmental Sciences, Lanzhou University, Lanzhou 730000; China;
3. Pingliang institute of soil and water conservation Science, Pingliang 744000; China;
4. College of Life Sciences, Gansu Agricultural University, Lanzhou 730070; China;
5. College of Agriculture,Gansu Agricultural University, Lanzhou 730070; China;
6. Natural Resources Bureau of Jingchuan County, Pingliang City, Pingliang 744000; China

**Abstract:** Zhonggou and Zhifanggou watershed in the Longdong Loess Plateau was chosen as the research areas, and the large-scale *Robinia pseudoacacia* plantations were selected as the research objects. They were planted in the slopes where farmland was transformed into grassland. Comprehensively considering its slope, aspect, forestage, planting density and other factors, 10 woodlands and 3 grassland sample plots have been established in the Zhonggou watershed, and 7 sample plots covered by *Cerasus humilis* shrub, alfalfa, wasteland and bare land with the four slope grades of 5°, 10°, 15°, and 20°in the watershed of the Zhifanggou have been selected. The TRIME pipe was buried in 2016, and the soil moisture was measured by the Time Domain Reflectometry (TDR) method. The measured data of soil moisture were obtained in the growing seasons from 2017 to 2019. The dataset includes: (1) Basic information of the sample plot (i.e., slope, aspect, and main stand structure data such as vegetation type, forest age, density, and DBH, as well as number and depth of TRIME pipe buried); (2) Soil moisture in Zhonggou watershed including 13 sample plots from May to October in 2017,13 sample plots from April to October in 2018, and 7 sample plots from July to October in 2019; soil moisture in the Zhifanggou watershed including data from May to July 2017, from April to September in 2018, and from February to July in 2019. The dataset was archived in .xlsx format with data size of 420 KB in 8 data files (compressed to 225.9 KB in two data files).

**Keywords: soil moisture; *Robinia pseudoacacia*; *Cerasus humilis* shrub; grassland conversion; Longdong**

**Received:** 01-11-2020; **Accepted:** 20-12-2020; **Published:** 24-12-2020

**Foundations:** National Natural Science Foundation of China (31660235) ; School innovative training prograrm (202010733033)

***Corresponding Author:** Di, L., College of Resources and Environment, Gansu Agricultural University, dili@gsau.edu.cn ; Wu, X. Z., School of Geography and Environmental Engineering, Lanzhou City College, wxz315@163.com

**Data Citation:** [1] Zhang, L. Y., Di, L., Wu, X. Z. *In Situ* soil moisture datasets in Zhonggou and Zhifanggou watershed of Longdong Loess Plateau (2017–2019) [J]. *Journal of Global Change Data & Discovery*, 2020, 4(4): 380–386. https://doi.org/10.3974/geodp.2020.04.09.

[2] Zhang, L. Y., Di, L., Wu, X. Z. Soil moisture dataset from woodland and grassland sample plots of Zhonggou watershed on Longdong Loess Plateau, China (2017–2019) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2020. https://doi.org/10.3974/geodb.2020.09.10.V1.

[3] Zhang, L. Y., Di, L., Wu, X. Z. Sample plots soil moisture dataset from four different land uses of Zhifanggou watershed on Longdong Loess Plateau, China (2017–2019) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2020. https://doi.org/10.3974/geodb.2020.09.11.V1.

**Loess Plateau**

**Dataset Availability Statement:**

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2020.09.10.V1 & https://doi.org/10.3974/geodb.2020.09.11.V1.

## 1 Introduction

The precipitation in the Longdong Loess Plateau, which located in eastern Gansu, is less and unevenly distributed, which results in low forest vegetation coverage, deterioration of ecological environment and serious soil erosion in this area. The relationship between vegetation and water resources is the core issue of ecological restoration and vegetation construction in the Longdong Loess Plateau. Chinese government has launched a series of key forestry ecological projects in this region, for example, a large area of ecological forests such as *Robinia pseudoacacia*, *Pinus tabulaeformis*, *Platycladus orientalis*, *Hippophae rhamnoides* and *Caragana korshinskii* have been constructed. Different vegetation types and plant species have different adaptive strategies for water use. However, the status of spatial and temporal distribution of soil moisture was neglected in large-scale plantation forests, especially pure plantations. In order to meet the needs of water, the plantations have rapidly expanded their roots and utilized deep soil water storage, resulting in the formation of soil drought layer in a certain soil depth in perennial plantations[1–2]. As a result, the survival rate and preservation rate of afforestation are low. Even if they survive, they grow very slowly and enter the degeneration stage earlier. Therefore, the expected effect of ecological project construction cannot be achieved[3–4]. With the increase of forest age, the degeneration of *Robinia pseudoacacia* plantations planted with simple structure and single species were gradually appeared. Because of its rapid growth and large water consumption, the soil under the forest is drying seriously with the increase of forest age, forming an obvious dry soil layer. The ecological environment is getting deterioration[5–7]. The emergence of the problems is diametrically opposed to the original purpose of constructing ecological restoration forests, and instead of achieving the expected goals. As a result, the ecological restoration effect is so poor in the later period. In this paper, two watersheds (Zhonggou and Zhifanggou) with 40 years of plantation in the Longdong Loess Plateau were selected as the sampling areas. The soil moisture in two watersheds with different restoration modes was measured and analyzed in order to grasp the distribution of soil moisture in the region and guide the restoration of plantation vegetation and the sustainable development of ecology in the region.

## 2 Metadata of the Dataset

The metadata of the "soil moisture dataset from woodland and grassland sample plots of Zhonggou watershed on Longdong Loess Plateau, China (2017–2019)" [8] and the "Sample plots soil moisture dataset from four different land uses of Zhifanggou watershed on Longdong Loess Plateau, China (2017–2019)"[9], including authors, geographical region, time, data format, data publishing and sharing service platform and data sharing policy, is shown in Table 1.

## 3 Study Area

Zhifanggou watershed in Pingliang city, Gansu province (35°26′N–35°33′N, 106°37′E –106°42′E) is located in the gully region of the Loess Plateau (Figure 1). The observation site is on the natural hillside of the Zhifanggou basin 0.9 km from Pingliang city. The basin is a first-level branch of the Jing River. The runoff measurement in the basin is one of main goal in the monitoring points in Gansu for the second phase of the construction of the national soil and water conservation monitoring network, as well as a part of information system which is a water erosion monitoring point in the key management area of the river basin. The total area of the basin is 18.98 km$^2$ with the altitude of 1,365–2,104 m.The annual average temperature is 8.8 °C, the annual average sunshine hours are 2,381 h and the pan evaporation is 1,499.2 mm, the annual average precipitation is 551.2 mm, of which 58% falls from July to September, and the soil type is mainly loessal soil[11]. The vegetation coverage is high more than 70% in upstream due to relatively high humid, where there are secondary trees and shrubs, the high dense grass. The vegetation coverage is about 40%-50% in the middle reaches where is dominated by weeds, and sparse shrubs on the shady slope. The vegetation coverage is between 20% and 40% in the downstream. There are 7 runoff plots in Zhifanggou watershed dominated by *Cerasus humilis* arranged with semi-shady slopes of 5°, 10°, 15° (two), and 20° (three). In addition, 15 plots are in grass slopes, 20 plots are in bare land, and 20 plots are in alfalfa land; runoff plots are all located at the bottom of the downstream ditch (Figure 2).

**Table 1** Metadata summary of "Soil moisture dataset from woodland and grassland sample plots of Zhonggou watershed on Longdong Loess Plateau, China" and "Sample plots soil moisture dataset from four different land uses of Zhifanggou watershed on Longdong Loess Plateau, China (2017–2019)"

| Items | Description |
|---|---|
| Data full name/short name | Soil moisture dataset from woodland and grassland sample plots of Zhonggou watershed on Longdong Loess Plateau, China (2017–2019) / SoilMoistureZhonggouRiverBasin<br>Sample plots soil moisture dataset from four different land uses of Zhifanggou watershed on Longdong Loess Plateau, China (2017–2019) / SoilMoistureZhifangRiverBasin |
| Authors | Zhang, L. Y., Gansu Agricultural University, 1397437506@qq.com<br>Di, L., Gansu Agricultural University, dili@gsau.edu.cn<br>Wu, X. Z., Lanzhou City University, wxz315@163.com<br>Zhang, J., Gansu Agricultural University, zhangjun@gsau.edu.cn<br>Wang, A. M., Pingliang Institute of Soil and Water Conservation, 593928177@qq.com<br>Ru, H. L., Pingliang Institute of Soil and Water Conservation, 1175332809@qq.com<br>Ni, F., Gansu Agricultural University, 1356159486@qq.com<br>Zhao, Z. L., Gansu Agricultural University, 1259701979@qq.com<br>Zhang, R. F., Gansu Agricultural University, 2757779009@qq.com<br>Wu, L., Gansu Agricultural University, 2889543138@qq.com<br>Li, H. Q., Gansu Agricultural University, 1824047417@qq.com<br>Su, X. L., Gansu Agricultural University, 3091274177@qq.com<br>Liu, J. J., Natural Resources Bureau of Jingchuan County, 1939225224@qq.com<br>Zhao, B. C., Gansu Agricultural University, 2388455308@qq.com<br>Yang, T., Gansu Agricultural University,1305004933@qq.com |
| Geographical region | Zhonggou and Zhifanggou watershed Year 2017–2019 Data format .xlsx |
| Foundation | National Natural Science Foundation of China (31660235) |
| Data publisher | Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn |
| Address | No. 11A, Datun Road, Chaoyang District, Beijing 100101, China |
| Share policy | ***Data*** from the Global Change Research Data Publishing &Repository includes metadata, datasets (in the *Digital Journal of Global Change Data Repository*), and publications (in the *Journal of Global Change Data & Discovery*). ***Data*** sharing policy includes: (1) ***Data*** are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use ***Data*** subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute ***Data*** subject to written permission from the GCdataPR Editorial Office and the issuance of a ***Data*** redistribution license; and (4) If ***Data*** are used to compile new datasets, the 'ten per cent principal' should be followed such that ***Data*** records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[10] |
| Communication and searchable system | DOI, DCI, CSCD, WDS/ISC, GEOSS, China GEOSS, Crossref |

Zhonggou watershed (35°12′N, 107°27′E) is located in Guanshan Forest Farm, Jingchuan county, Pingliang city, with an area of 2.09 $km^2$, altitude of 1,005–1,351 m, which belongs to a temperate semi-humid climate zone. Precipitation accounting for about 66% of the total falls from June to September. The annual average temperature is 10.7 °C[11] and the annual frost-free period is about 180 days. The main topography of the study area is composed of plateau surface, beam slope, ditch platform and ditch bottom. The relative elevation difference is about 350 km in the watershed. There are four main types of soil such as black loessial, loessial soil, silty loam, and red clay. The black loessial soil is mostly distributed in the plateau surface, the loessial soil is mostly distributed in the beam slope, the silty loam is mostly distributed in the ditch platform, and the red clay is mostly distributed in the ditch bottom[12–14]. Soil erosion is serious in the study area. The watershed is located in the transition zone of forest and grassland. The existing forest vegetation has been artificially planted in the past 40 years by Guanshan Forest Farm, the dominant species planted being *Robinia pseudoacacia*. Soil erosion is serious in the study area. The Information of sample plots in Zhifanggou watershed is shown in Table 2 and the Information of sample plots in Zhonggou watershed is shown in Table 3.

**Figure 1** The relative position of Zhifanggou and Zhonggou watershed

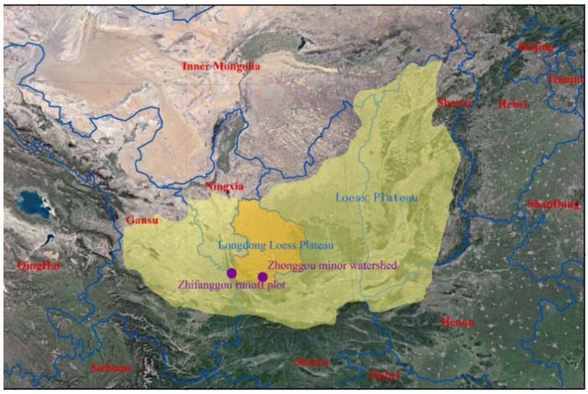


**Figure 2** Distribution of observation samples site in Zhonggou watershed

## 4 Soil Moisture Observation

The soil moisture is usually measured by soil moisture quick-monitoring instrument (TRIME-PICO) (Figure 3) and soil weight moisture is measured by the drying method[15].

TRIME tubes were buried in 13 selected sample plots in 2016 (Figure 4–5). Soil moisture was measured every 15 days from the middle and late April to early November. It lasted the entire growth period of the tree. The maximum test depth is 300 cm. Data is read and recorded every 20 cm, synchronized with the observation of earth drill.

**Table 2** Summary of sample plots information in Zhifanggou watershed

| Sample site | Slope (°) | Slope position | Vegetation types | Land preparation method | Sowing method | Density (plants·$ha^{-1}$) |
|---|---|---|---|---|---|---|
| 1 | 5° | Slope bottom | *Cerasus humilis* | level terrace | hole-seeding | 20,000 |
| 2 | 10° | Slope bottom | *Cerasus humilis* | level terrace | hole-seeding | 20,000 |
| 3 | 15° | Midslope | *Cerasus humilis* | level terrace | hole-seeding | 20,000 |
| 4 | 15° | Midslope | wasteland | abandonment | | |
| 5 | 20° | Midslope | *Cerasus humilis* | level terrace | hole-seeding | 20,000 |
| 6 | 20° | Midslope | bare land | abandonment | | |
| 7 | 20° | Midslope | alfalfa | abandonment | sowing | |

* All sample plots are in a slope direction (313°) and are buried with three 2-m TRIME pipes with varying test depths depending on test conditions. *Cerasus humilis* was planted in spring 2017 and it was watered 4 times that year, and then there was no irrigation.

**Table 3** Sample plots information of Zhonggou watershed

| Sample site | Geo-location | Forest age (year) | Type of sample site | Geomorphological site | Aspect (°) | Slope (°) | Density (plants·ha$^{-1}$) | Average DBH (cm) | Average height (m) | Canopy density | Trime-tube quantity | Measuring pipe depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 35°20′25″N 107°31′2″E | 35 | *Robiniapseudoacacia* | ridge slope | 233° | 35° | 4,563 | 7.83 | 5.63 | 0.87 | 3 | 3 |
| 2 | 35°20′32″N 107°31′9″E | 30 | *Robiniapseudoacacia* | tableland | 339° | 15° | 2,196 | 13.22 | 11.90 | 0.82 | 3 | 3 |
| 3 | 35°20′41″N 107°31′11″E | 25 | *Robiniapseudoacacia* | tableland | 332° | 13° | 750 | 16.24 | 13.88 | 0.8 | 3 | 3 |
| 4 | 35°20′47″N 107°31′11″E | 25 | *Robiniapseudoacacia* | tableland | 9° | 2° | 1,600 | 15.66 | 12.83 | 0.83 | 3 | 3 |
| 5 | 35°20′44″N 107°31′55″E | 20 | *Robiniapseudoacacia* | ditch platform | 218° | 17° | 5,400 | 9.16 | 11.07 | 0.86 | 3 | 3 |
| 6 | 35°20′22″N 107°31′6″E | 35 | *Robiniapseudoacacia* | ridge slope | 227° | 16° | 3,780 | 11.54 | 8.36 | 0.82 | 2 | 2 |
| 7 | 35°21′1″N 107°31′36″E | 25 | *Robiniapseudoacacia* | tableland | 341° | 8° | 1,227 | 15.50 | 14.46 | 0.8 | 2 | 3 |
| 8 | 35°20′56″N 107°31′34″E | 25 | *Robiniapseudoacacia* | tableland | 216° | 2° | 1,625 | 16.94 | 13.24 | 0.79 | 2 | 3 |
| 9 | 35°20′51″N 107°31′33″E | 25 | *Robiniapseudoacacia* | tableland | 247° | 18° | 1,000 | 14.20 | 11.96 | 0.82 | 2 | 3 |
| 10 | 35°20′10″N 107°31′7.5″E | 25 | *Robiniapseudoacacia* | ridge slope | 255° | 29° | 3,550 | 6.15 | 7.6 | 0.88 | 2 | 3 |
| 11 | 35°20′42″N 107°31′8.5″E | | unused grass | tableland | 239° | 22° | | | | | 2 | 2 |
| 12 | 35°20′44″N 107°31′2″E | | unused grass | ridge slope | 225° | 35° | | | | | 3 | 3 |
| 13 | 35°20′43″N 107°31′53″E | | unused grass | ditch platform | 257° | 10° | | | | | 2 | 3 |

The advantages of measuring soil moisture by using soil moisture quick- monitoring instrument are simple operation, fast measurement speed and continuous measurement, which can be used to measure soil surface moisture and section moisture, and the measurement data are easy to process. But the first three months of TRIME pipe embedded will disturb the soil and it is not suitable for measurement.

**Figure 3** Observation of soil moisture quick-monitoring instrument

**Figure 4** Experimental plot of Zhonggou watershed

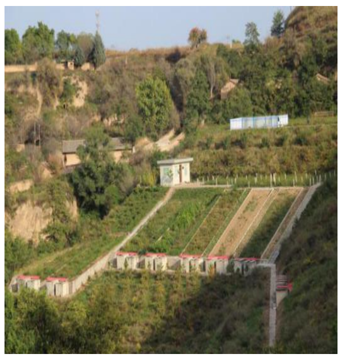

**Figure 5** Experimental plot of Zhifanggou watershed

## 5 Data Results and Analysis

In the same period of 2018, we compared the soil moisture of *Robinia pseudoacacia* plantations in Zhonggou watershed with that of *Cerasus humilis* shrub in Zhifanggou watershed (Figure 6) and soil moisture of unused grassland in Zhonggou with that of waste grass slope in Zhifanggou (Figure 7).

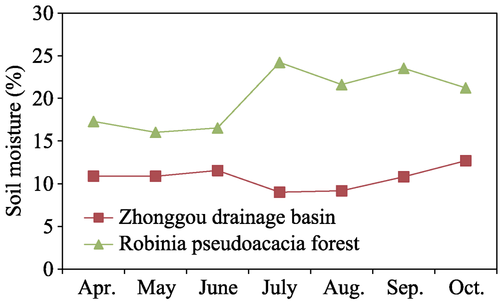


**Figure 6** Soil moisture of *Robinia pseudoacacia* plantations in Zhonggou and *Cerasus humilis* shrub in Zhifanggou

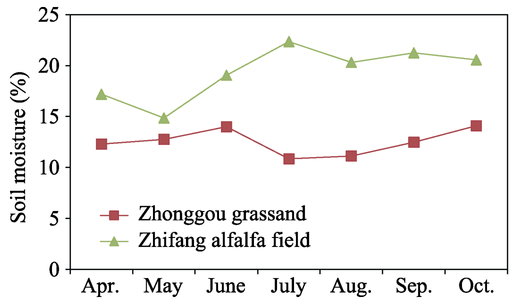


**Figure 7** Soil moisture of unused grassland in Zhonggou forest and waste grass slope in Zhifanggou

The soil moisture of *Cerasus humilis* forest in Zhifanggou is higher than that of *Robinia pseudoacacia* forest in Zhonggou. The soil moisture of *Robinia pseudoacacia* forest in Zhougou increased slightly from April to June, decreased from June to July, and increased slowly from August, while the soil moisture of *Cerasus humilis* forest in Zhifanggou decreased slightly from April to May, and increased rapidly in May to July and then there was a downward-rising-decreasing fluctuation. In addition, the soil moisture of the *Robinia pseudoacacia* forest in Zhonggou reached the minimum value of 9.01% in July, while the soil moisture of the *Cerasus humilis* forest in Zhifanggou reached the maximum value of 24.22% in July.

The soil moisture of alfalfa grassland in Zhifanggou was also higher than that in Zhonggou grass slope. The soil moisture in Zhonggou grassland increased slowly from April to June, decreases significantly from June to July, and then decreased gradually from June to July. While the soil moisture in Zhifanggou alfalfa grassland decreased significantly from April to May period and July, increased rapidly from May to July, and then showed wave dynamic. Similarly, the soil moisture of Zhonggou grassland reached the lowest value of 10.86% in July, and the soil moisture in Zhifanggou grass slope reached its highest value of 22.35% in July.

Figure 8 and Figure 9 show the soil moisture of unused land under different vegetations in the Zhifanggou watershed and the soil moisture of unused grassland under different landform types in the Zhonggou watershed in 2018, respectively.

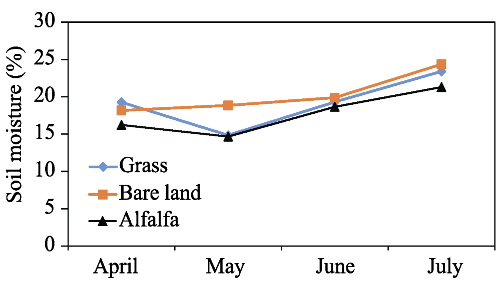


**Figure 8** Soil moisture of unused land under different vegetation in Zhifanggou watershed

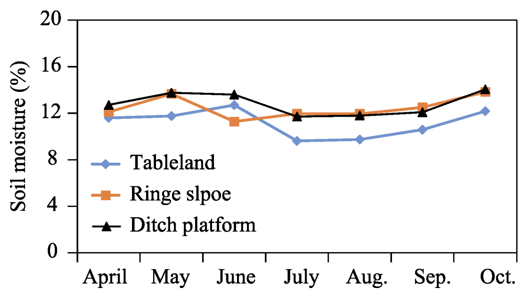


**Figure 9** Soil moisture of barren grassland under different landform types in Zhonggou watershed

The soil moisture of bare land in the Zhifanggou watershed was significantly higher than that of barren grassland and alfalfa land. The change trend of soil moisture of barren grassland and alfalfa land was the same, and both decreased first and then increased. The soil moisture of barren grassland was slightly higher than that of alfalfa land. Under different landform types, the soil moisture of unused grassland was shown a "S"-shaped fluctuation that first increased and then decreased. Whether it is woodland or grassland, the soil moisture of Zhifanggou is larger than that of Zhonggou. The reason may be that the runoff plots in the watershed of Zhifanggou are all located in the downstream of the watershed and close to the bottom of the valley. In the next study, a new runoff observation field has been considered on different slope positions in the upstream of Zhifanggou.

### *Author Contributions*

Di, L. made the total design of the layout of the experiment and the development of the dataset. Wu, X. Z. assisted in experimental design and field observation layout. Zhang, L. Y., Ren, Y. B., and Ni, F. were mainly responsible for data analysis. Wang, A. M., Ru, M. L., Zhao, Z.L., Wu, L., and Zhang, R. F., *et al*. were responsible for data collection. Di, L., Zhang, L. Y., Zhang, J., and Wu, X. Z. carried out data verification and wrote manuscript.

## References

[1] Xu, P. H., Chen, Y. M., Wu, F. Effects different improvement measures of degradated robinia pseudoacacia in semi-arid loess hilly region [J]. *Journal of Northwest Forestry University*, 2009, 24(4): 109–113.

[2] Liu, X. X., He, Q. Y., Yan, M. J., *et al*. Trunk sap flow dynamic characteristics of dominant and main associated species of quercus liaotungensis community in loess hilly and semi-arid region [J]. *Acta Zoologica Sinica*, 2018, 38(3): 4744–4751.

[3] Zhang, J., Di, L., Li, X. Y., *et al*. Measured soil moisture dataset of Zhonggou watershed in the Loess Plateau of Eastern Gansu (2018) [J]. *Journal of Global Change Data & Discovery*, 2019, 3(4): 349– 355.

[4] Liu, J, J., Cheng, L. L., Yu, X. X.. Influencing factors and research progress of tree transpiration water consumption [J]. *World forestry research*, 2009, 22(4): 34–40.

[5] Shao, M. A., Jia, X. X., Wang, Y. Q., *et al*. Research progress and Prospect of soil dry layer in Loess Plateau [J]. *Progress in Earth Science*, 2016, 31(1): 14–22.

[6] Wang, L., Shao, M. A., Wang, Q. J., *et al*. Comparison of soil drying status between natural forest and Robinia pseudoacacia plantation in Ziwuling of Loess Plateau [J]. *Acta botany Sinica*, 2005(7): 1279–1286.

[7] Jia, X. X., Shao, M. A., Zhu, Y. J., *et al*. Soil moisture decline due to afforestation across the Loess Plateau, China [J]. *Journal of Hydrology*, 2017, 546: 113–122.

[8] Zhang, L. Y., Di, L., Wu, X. Z. Soil moisture dataset from woodland and grassland sample plots of Zhonggou watershed on Longdong Loess Plateau, China (2017–2019) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2020. https://doi.org/10.3974/geodb.2020.09.10.V1.

[9] Zhang, L. Y., Di, L., Wu, X. Z. Sample plots soil moisture dataset from four different land uses of Zhifanggou watershed on Longdong Loess Plateau, China (2017–2019) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2020. https://doi.org/10.3974/geodb.2020.09.11.V1.

[10] GCdataPR Editorial Office. GCdataPR data sharing policy [OL]. https://doi.org/10.3974/dp.policy.2014.05 (Updated 2017).

[11] Wang, M. Y., Wang, B. T. Effects of different soil and water conservation measures on annual runoff and sediment yield in watershed of Loess Plateau: a case study of Zhifanggou, Pingliang [J]. *Forestry science*, 2016, 52(8): 10–20.

[12] Han, F., Ren, Y., Wang, A. M., *et al*. Response of soil moisture in *Robinia pseudoacacia* forest land to rainfall in Jingchuan Zhonggou watershed, Gansu province [J]. *Agricultural science and information*, 2015(1): 31–33.

[13] Jing, G. Y. Study on ecological and hydrological functions of litter layer and soil layer of artificial *Robinia pseudoacacia* forest in Loess Plateau of Eastern Gansu [D]. Lanzhou: Gansu Agricultural University, 2017.

[14] Jing, G. Y., Di, L., Wang, A. M., *et al*. Study on soil water physical properties and permeability of different age artificial Robinia pseudoacacia Forests in Jingchuan, Gansu Province [J]. *Journal of Sichuan Agricultural University*, 2017, 35(2): 193–198

[15] Brief introduction of the National Standard of the People's Republic of China on Long-term Positioning and Observation of Forest Ecosystems (GB/T33027—2016) in China [J]. *Journal of Temperate Forestry Research*, 2018, 1(1): 6, 36.