ABSTRACT ID: EGU2012-635

Effects of Mattic Epipedon on Surface Soil Hydraulic Properties of Alpine Meadow Soil

Chen ZENG[1,*], Fan ZHANG[1], Xuedong YAN[2]

[*] Corresponding author, email: zengchen@itpcas.ac.cn

[1] Key Laboratory of Tibetan Environment Changes and Land Surface Processes, Institutes of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China;
[2] MOE Key Laboratory for Urban Transportation Complex Systems Theory and Technology, Beijing Jiaotong University, Beijing, China

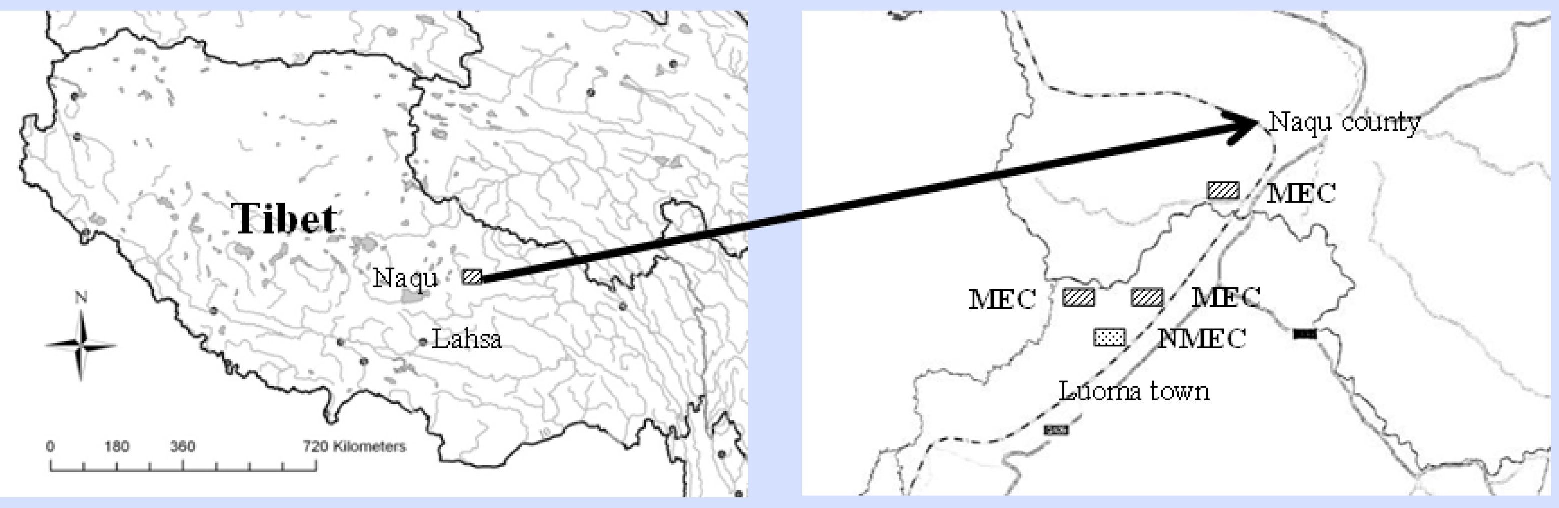
1. Introduction

Alpine meadow soil is an important ecosystem component of the Tibetan Plateau. Existence of mattic epipedon in the alpine meadow soil surface changes soil physicochemical characteristics. Effects of mattic epipedon on local ecology and heat transfer in soil profile have been well studied, however, little attention has been paid to its effect on soil hydraulic properties.

The objective of this study was to investigate the effects of mattic epipedon layer on surface soil hydraulic properties of alpine meadow soil compared with bare surface.

2. Sampling sites and methods

This study was conducted in Naqu District, Tibet Autonomous Region, China. Three mattic epipedon covered (MEC) sites and one no mattic epipedon covered (NMEC) contrastive site were investigated.



Vegetation coverage was investigated by gray-level image method. Soil water distribution and redistribution profiles were measured using HH2 moisture meter with ML2x theta probe in digging holes.

The mattic epipedon layer has a rough surface and contains abundant roots, which is quite different from the deeper soil layers. Therefore, inverse solution method (Zeng et., 2012) was used to obtain soil hydraulic parameters using the HYDRUS-2D software. The calculated parameters were verified by another set of infiltration observation data.

3. Results

3.1 Vegetation coverage of mattic epipedon

Replication	MEC Site1	MEC Site2	MEC Site3	NMEC Site
1	67.0	42.6	49.2	7.5
2	53.4	48.1	53.3	10.6
3	61.5	57.8	56.9	5.5
4	84.3	46.4	61.4	6.4
5	76.5	74.9	62.3	9.5
6	56.2	79.9	65.1	8.7
7	60.2	62.3	67.2	8.2
8	73.6	70.3	73.2	4.6
9	58.0	67.5	77.4	11.3
Mean	**65.6**	**61.1**	**62.9**	8.0
S.D.	10.5	13.3	9.1	2.3
CV%	16.0	21.7	14.4	28.3

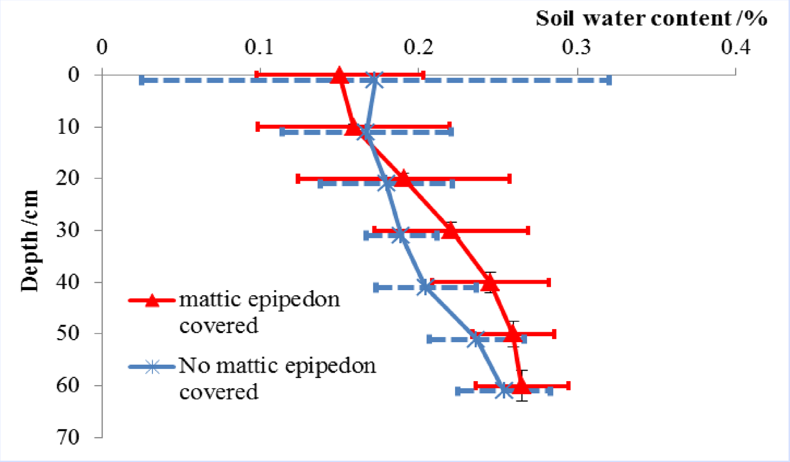
Mean vegetation coverage shows that the mattic epipedon of the study region has been subject to moderate degradation (Xue et., 2007). The main possible causes are rodents and soil erosion.

3.2 Basic soil properties

	Bulk density g/cm^3	Root density g/m^3	Organic matter g/kg	Total N g/kg	Total P g/kg	Total K g/kg	Soil particle content /% <0.1 mm	0.1-0.5 mm	>0.5 mm
mattic epipedon layer (0-20 cm)	0.99	3852.1	64.16	2.86	0.535	22.06	87.57	4.23	8.2
under mattic epipedon layer (20-60 cm)	1.24	123.9	52.38	2.346	0.479	20.89	60.84	27.51	11.65
No mattic epipedon covered	1.33	90.6 (0-20cm) 0(>20cm)	28.54	1.237	0.413	20.45	54.55	25.72	19.73

- The mattic epipedon layer has better porosity and nutrient condition and contains more clay.

3.3 Soil water distribution under normal condition



- Soil water profiles showed that MEC contains more water than NMEC except for the 0-10 cm top layer.

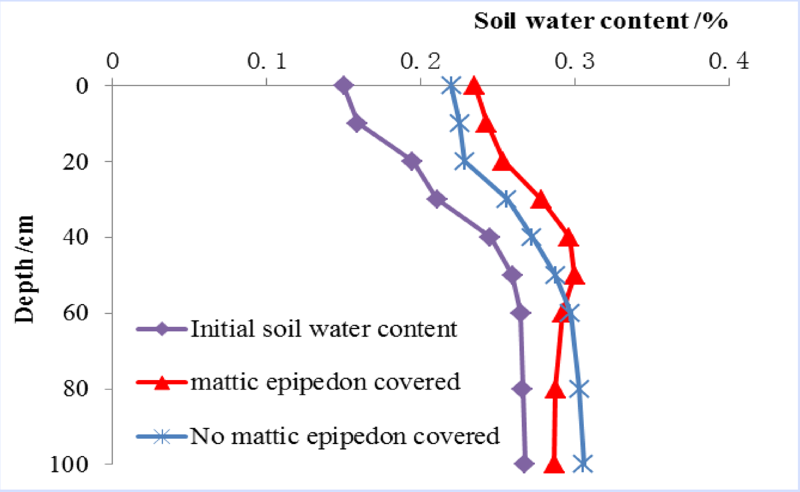
3.4 Soil hydraulic parameters

		K_s cm/min	θ_s %	θ_r %	a	n
MEC	mattic epipedon	0.112	33.5	2.0	0.052	1.716
	below mattic epipedon	0.365	44.5	12.0	0.122	1.905
NMEC		0.557	43.1	8.1	0.094	2.120

- The mattic epipedon layer has the lowest hydraulic conductivity. Both the mattic epipedon layer and the layer blow in MEC soil has lower hydraulic conductivity than NMEC soil.
- Compared to the NMEC soil, the mattic epipedon layer has the lowest soil water storage capacity and the layer below mattic epipedon has the highest soil water storage capacity. It should be noted that the θ_s does not consider the water storage capacity of the roots in the soil.

3.5 Soil water redistribution

An infiltration event modeling simulated redistribution process of 100 mm water infiltrating into soil during 12 hours.



With MEC, more water can be retained in shallow layer, which fits the water requirement of vegetation roots in surface soil.

4. Conclusion

➢**Generally, MEC soil profile contains more water than NMEC.**

➢**Mattic epipedon enables soil to retain more water in shallow layers after infiltration event.**

➢**Existence of mattic epipedon layer fits the water demand of vegetation roots in surface soil.**

Thank you for your attention!

References

C. ZENG, Q. WANG, F. ZHANG, 2012. Evaluation of hydraulic parameters obtained by different measurement methods for heterogeneous gravel soil. Terrestrial, Atmospheric and Oceanic Sciences. Special issue on "Impacts and Adaptation of Climate Change on Watershed Management and Hydrology". In press.

Xue X., Guo J., Zhang F., et al., 2007. Development and Cause of Aeolian Desertification in Alpine Region - In Case of Maduo County in Yellow River Source Area. Journal of Desert Research, 27 (5), 725-732. (in chinese)