Disappearing water– Effects of Grass and Forests and the Infiltration Amount on Preferential Flow in Karst Regions of China

Xiaoqing Kan[1], Jinhua Cheng[2]

1.College of Soil and Water Conservation, Beijing Forestry University

2. Jianshui Research Station, School of Soil and Water Conservation, Beijing Forestry University, No. 35 Qinghua East Road, Haidian District, Beijing 100083, China
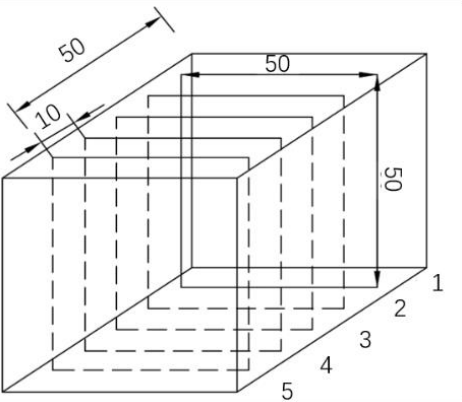
What happened?

- **Basic information**

➤ Yangjie Catchment
(102°55'E, 23°37′–23°44'N)

Site Type	Land Coverage (%)	Main Plant Type	Tree Height (m)	Stand Density (m)	Stained Images (-)	Fields Environmental Photos (-)
PY [1]	65	*Pinus Yunnanensis*	7.20	2 × 2	50	
SF [2]	80	*Quercus baronii Skan; Rhamnus leptophylla Schneid; Crataegus cuneata; Pistacia chinensis Bunge; Coriaria nepalensis Wall*	5.90	3 × 4	40	
G [3]	95	*Themeda triandra Forsk. Var. Japonica (Willd.) Makino*	-	-	60	

[1] PY corresponds to *Pinus Yunnanensis* plantation forestland. [2] SF correspond to secondary forestland. [3] G corresponds to natural grassland.
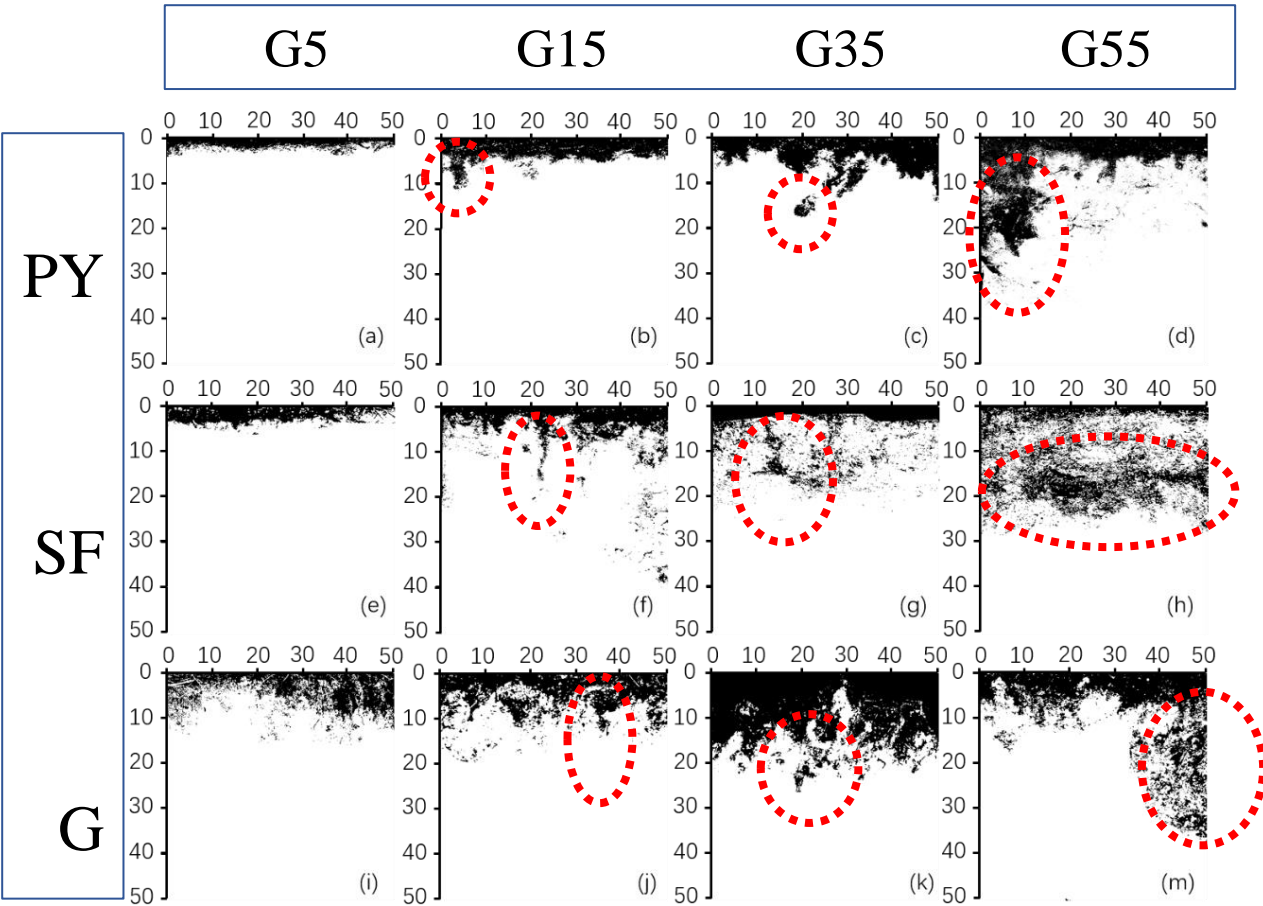
Vertical slices → Field slices → After treatment

➤ Dyeing experiment

Reasons

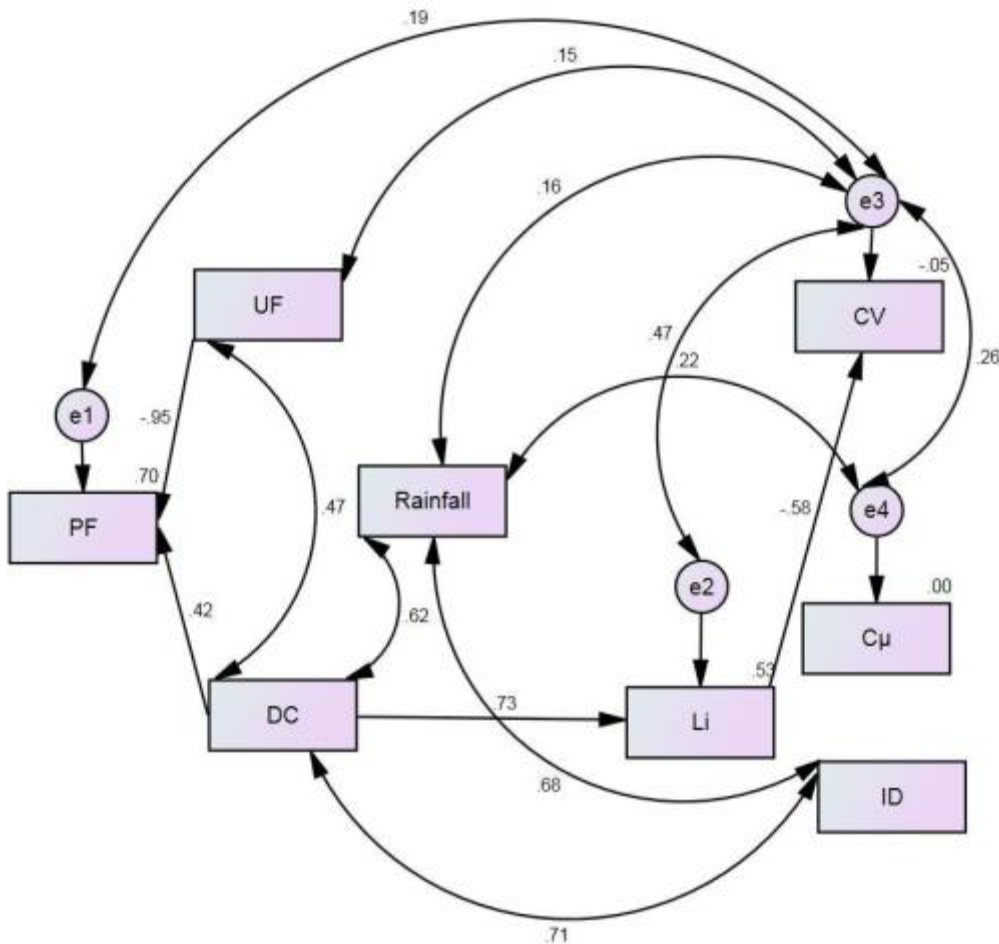> Average dye coverage (DC) (yellow curve) and standard deviation (black part) of three site types.

> (a), (b), (c) and (d) correspond to the vertical sections of PY at G5, G15, G35 and G55, respectively; (e), (f), (g) and (h) refer to the vertical sections of SF at G5, G15, G35 and G55, respectively; (i), (j), (k) and (m) correspond to the vertical sections of G at G5, G15, G35 and G55, respectively.
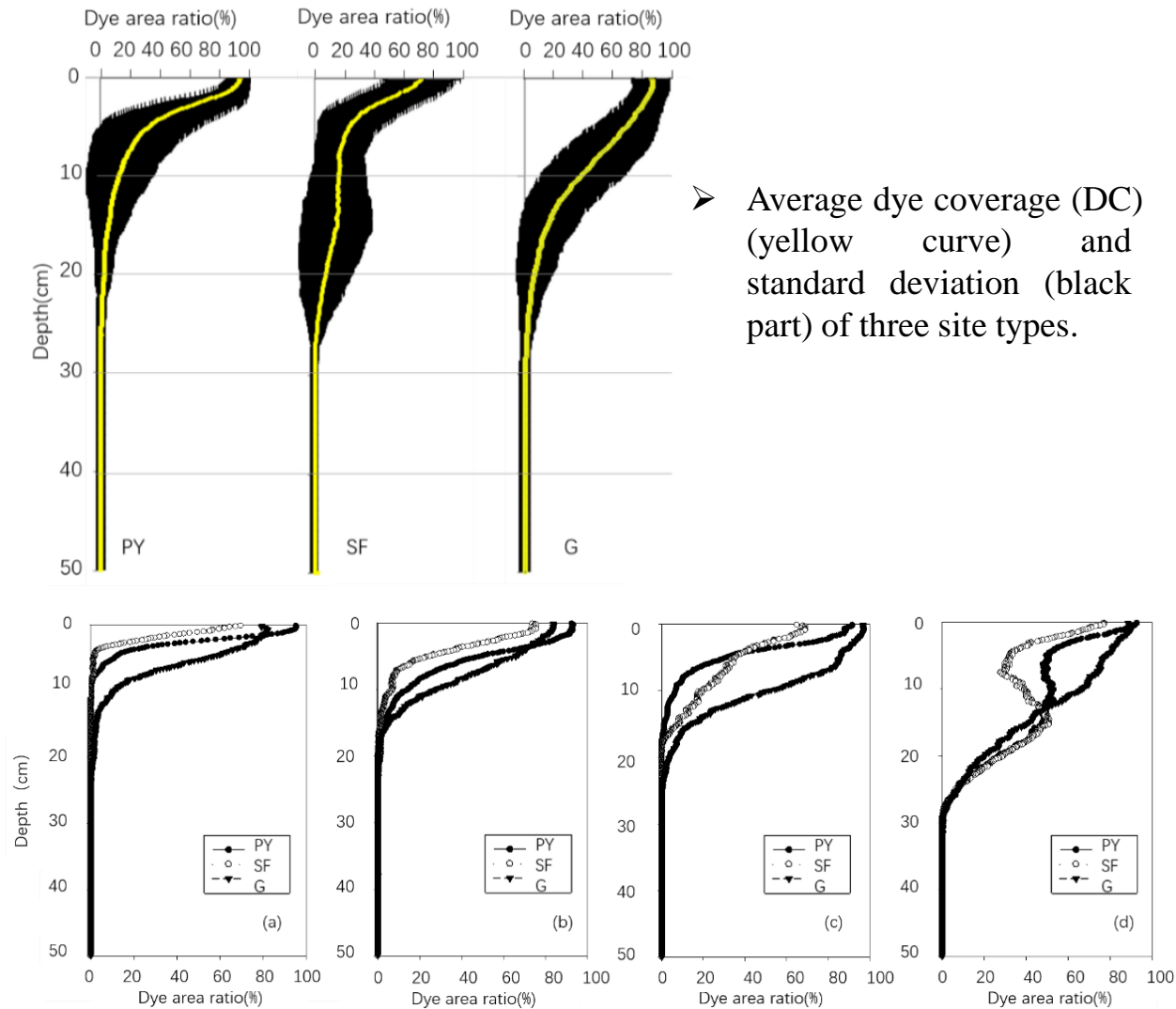
> Average DC curve under different precipitation amounts (a is G5, b is G15, c is G35, d is G55). G5, G15, G35 and G55 correspond to 5 mm, 15mm, 35mm and 55mm ponded water infiltration simulation, which simulate the change of ponded water in light rain, medium rain, heavy rain and storm, respectively.

Reasons

> SEM of preferential flow characteristic parameters (e represents the errors).

> Correlation analysis between cumulative content of nutrients in soil and characteristic parameters of preferential flow.

Element Name	UF	ID	DC	PF	L_i	C_V	C_μ
AK [1]	0.69 * [7]	0.86 ** [8]	0.81 **	−0.23	0.82 **	−0.81 **	−0.90 **
NN [2]	−0.26	−0.18	−0.28	0.06	−0.15	0.05	0.14
TN [3]	−0.22	0.46	0.11	0.61	0.56	0.16	−0.42
AP [4]	0.83 **	0.74 *	0.85 **	−0.44	0.73 *	−0.89 **	−0.85 **
TP [5]	−0.31	0.41	−0.07	0.68 *	0.59	0.30	−0.40
Org [6]	−0.84 **	−0.19	−0.68 *	0.87 **	0.06	0.82 **	0.18

[1] AK corresponds to available potassium/ug·mL^{-1}. [2] NN corresponds to nitrate nitrogen/mg·kg^{-1}. [3] TN corresponds to total nitrogen/g·kg^{-1}. [4] AP corresponds to available phosphorus/mg·kg^{-1}. [5] TP corresponds to total phosphorus/g·kg^{-1}. [6] Org corresponds to organic matter/%. [7] * correlation is significant at a 0.05 level (two-tailed). [8] ** correlation is significant at a 0.01 level (two-tailed).

Conclusions

- **Preferential flow under this special geomorphological type is worth studying.**

- **Reasonable allocation of plantation forests has a certain mitigation effect on soil erosion in Karst areas.**

- **The contribution of preferential flow to groundwater and solute transport need to be studied under more kinds of vegetation types because of the limitations in the sample size.**