Variations of ^{7}Be concentration in plants and its significance for ^{7}Be in soil on the Loess Plateau, China: Based on three-year monitoring data

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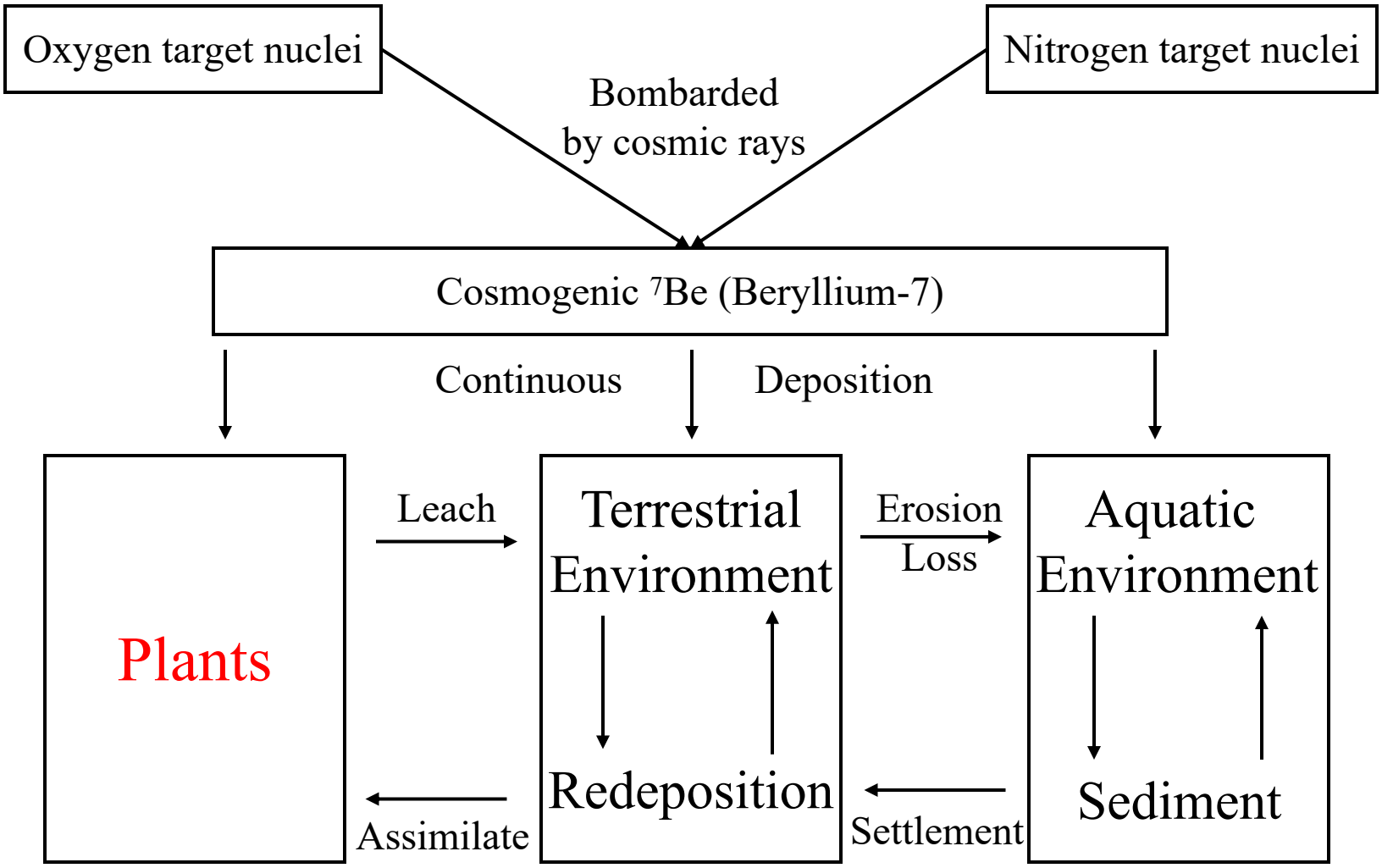
Introduction

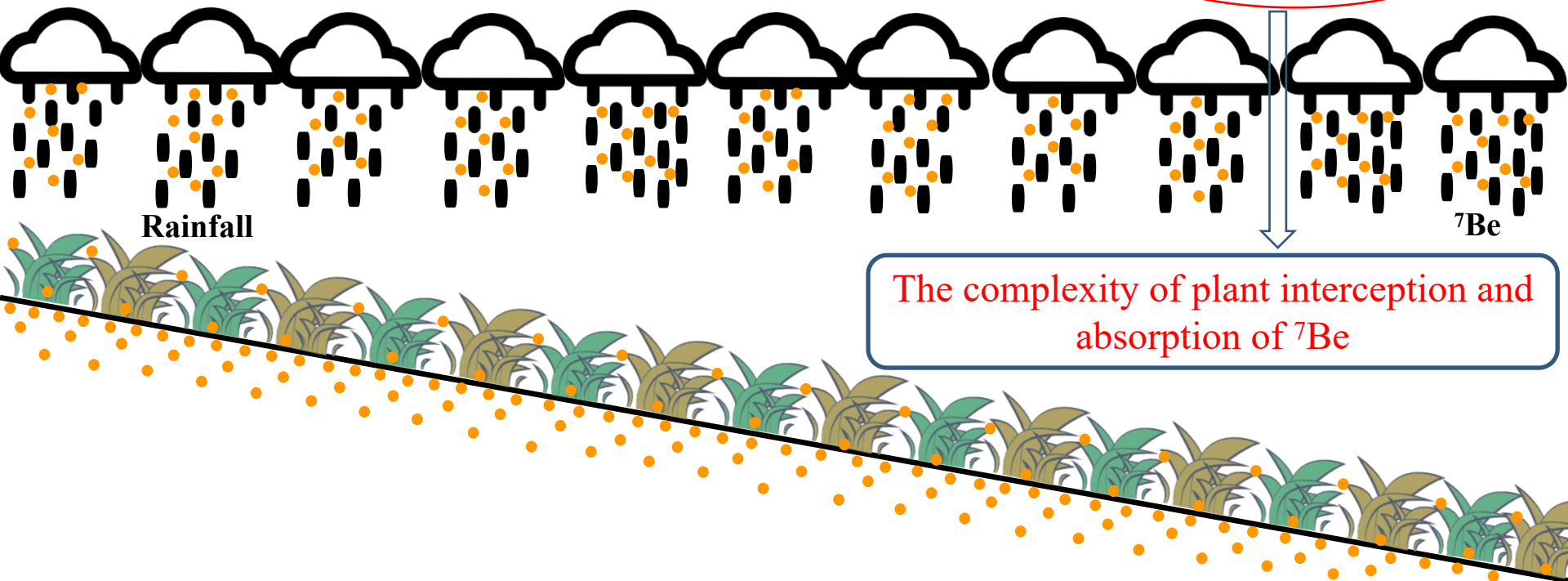


Introduction

^{7}Be tracing technique

Bare slopes and agricultural land

Vegetation-covered slopes



The complexity of plant interception and absorption of ^{7}Be

Introduction

The aim of the study

Explore the dynamic patterns of ^{7}Be concentration in predominant plants

Elucidate the factors influencing ^{7}Be concentration in plants

Characterize the significance of plants in the process of ^{7}Be deposition on natural slopes

Improve the accuracy of ^{7}Be tracing technique, and broaden its application scope in documenting soil erosion

Materials and Methods

Experimental design

Six single-species samples

Living and dead plants of mixed species

Soil reference

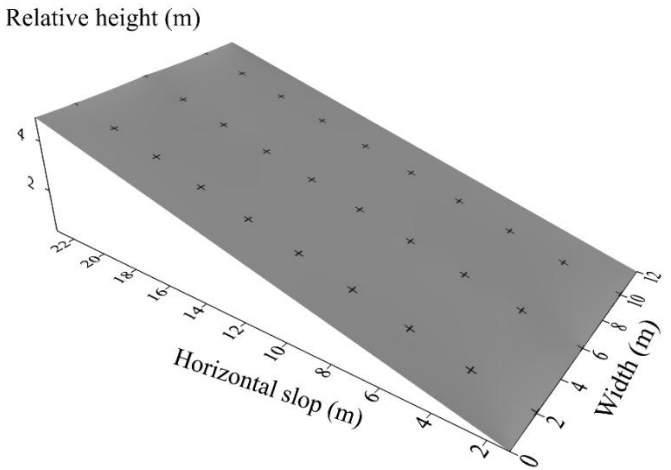
Dried, pulverized and measured

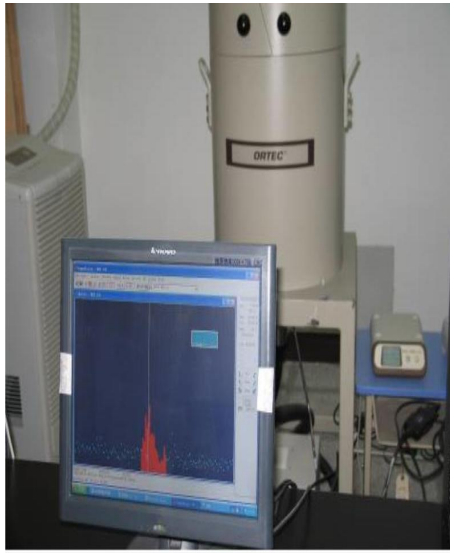
Obtain

^{7}Be concentration in plants and soil

Dry biomass vegetation coverage

Daily precipitation

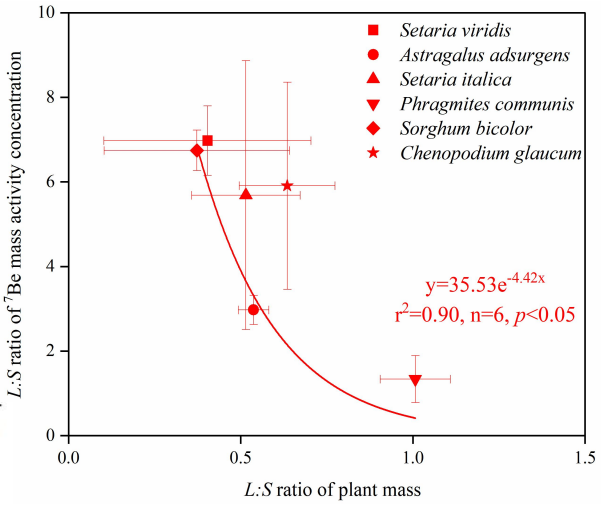




Results

The concentrations of ^{7}Be in plants displayed similar behavior in all 6 species, i.e. an increase during the growth period

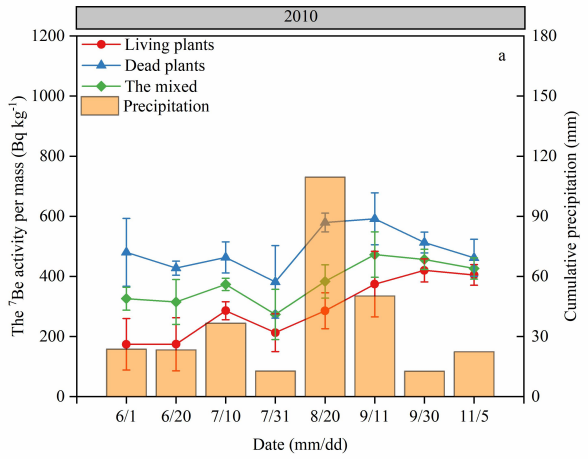
Species	Plant part	11-Aug-2012		3-Sep-2012		25-Sep-2012		Mean activity (Bq kg^{-1})	Mean *L:S* Ratio
		Activity (Bq kg^{-1})*	*L:S* Ratio	Activity (Bq kg^{-1})	*L:S* Ratio	Activity (Bq kg^{-1})	*L:S* Ratio		
Setaria viridis (L.) Beauv	Whole	114 ± 16.2		254 ± 21.9		326 ± 19.2		231 ± 108	
	Leaves	227 ± 19.6	7.92	851 ± 33.2	6.56	1003 ± 33.5	6.45	694 ± 411	6.98[a]
	Stem	28.7 ± 13.6		130 ± 17.1		156 ± 19.9		105 ± 67.1	
Astragalus adsurgens Pall	Whole	74.0 ± 11.7		133 ± 17.4		244 ± 16.1		150 ± 86.3	
	Leaves	126 ± 15.9	2.59	237 ± 27.3	3.09	434.5 ± 27.5	3.25	266 ± 156	2.97[bc]
	Stem	48.6 ± 9.6		76.7 ± 12.1		134 ± 16.0		86.3 ± 43.3	
Setaria italica	Whole	108 ± 15.3		289 ± 17.1		326 ± 32.5		241 ± 117	
	Leaves	202 ± 16.4	3.98	529 ± 16.6	3.73	989 ± 25.8	9.36	573 ± 395	5.69[ab]
	Stem	50.9 ± 14.6		142 ± 17.5		106 ± 15.4		99.5 ± 45.8	
Phragmites communis (Cav.) Trin. ex Steud	Whole	58.2 ± 10.8		242 ± 13.9		520 ± 20.2		273 ± 233	
	Leaves	75.8 ± 9.63	1.95	224 ± 14.8	0.86	572 ± 18.0	1.21	291 ± 255	1.34[c]
	Stem	38.9 ± 12.0		260 ± 13.0		474 ± 20.2		258 ± 217	
Sorghum bicolor (L.) Moench	Whole	79.1 ± 15.8		224 ± 19.9		318 ± 22.6		207 ± 120	
	Leaves	162 ± 20.4	7.27	701 ± 48.5	6.63	1089 ± 38.2	6.33	651 ± 466	6.75[a]
	Stem	22.3 ± 12.6		106 ± 13.5		172 ± 12.0		100 ± 75.0	
Cheno-podium glaucum L	Whole	37.5 ± 13.8		43.1 ± 12.4		194 ± 18.0		91.4 ± 88.6	
	Leaves	65.2 ± 25.5	3.53	97.1 ± 28.9	5.78	480 ± 59.5	8.42	214 ± 231	5.91[ab]
	Stem	18.5 ± 6.58		16.8 ± 8.81		57.0 ± 19.7		30.8 ± 22.8	

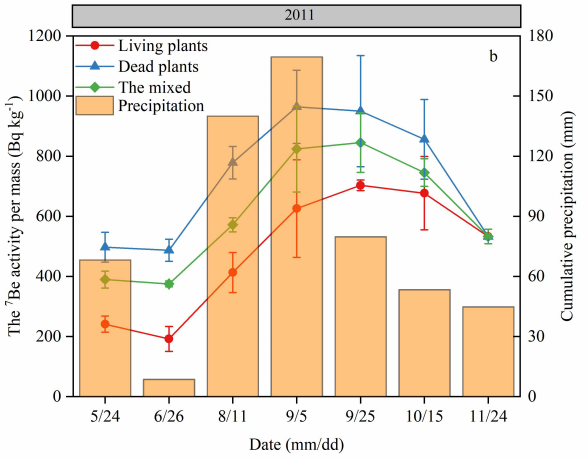


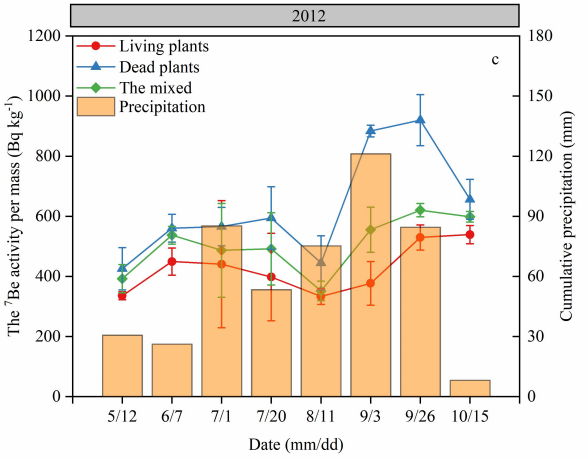
The difference in plant biomass and leaf quality is also the main factor affecting ^{7}Be concentration

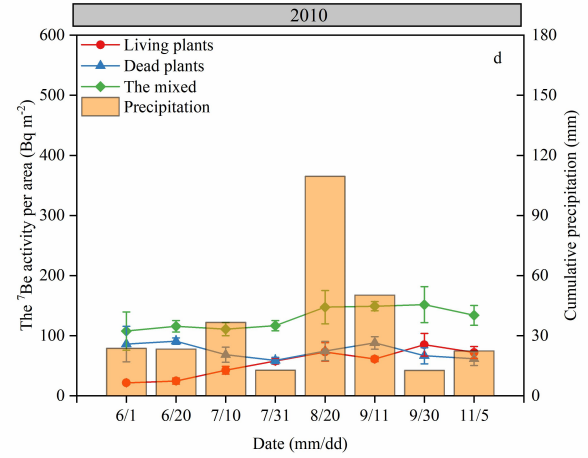
Results

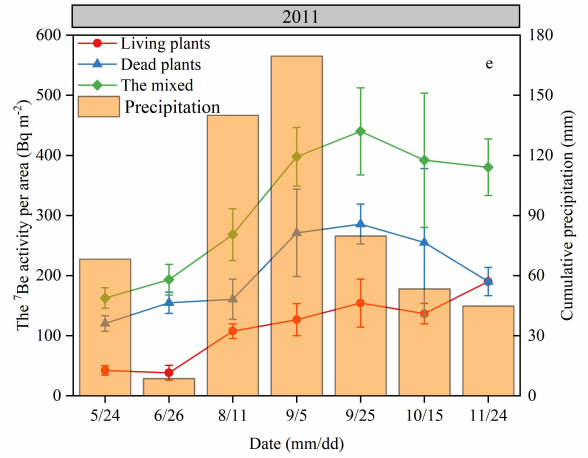
Increased during the growing season, but at a decreasing rate from October to November following decreasing precipitation.

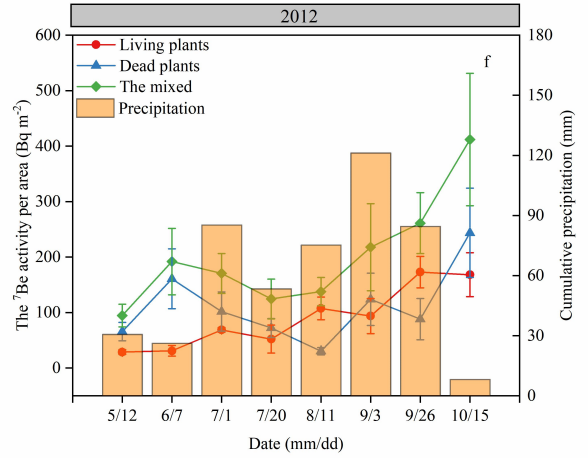




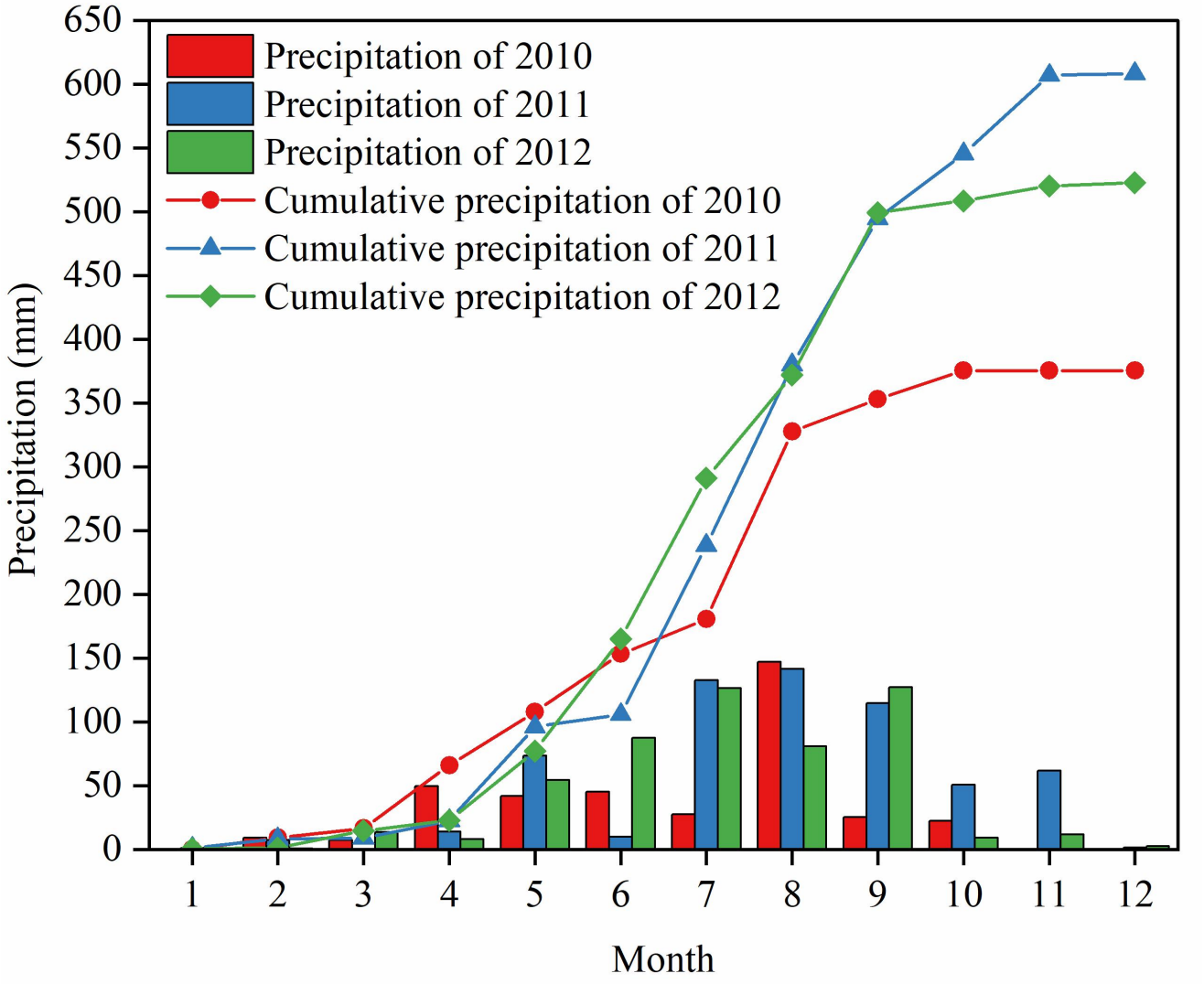








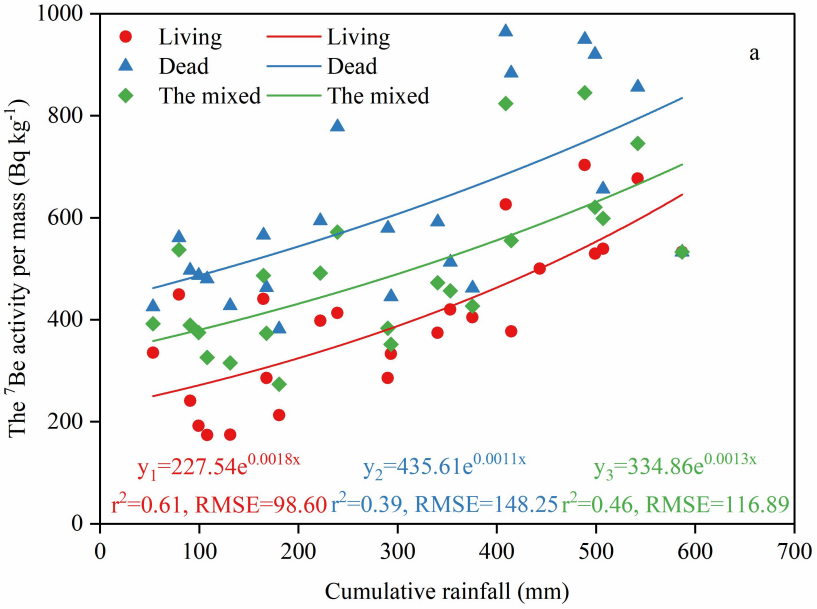
Results

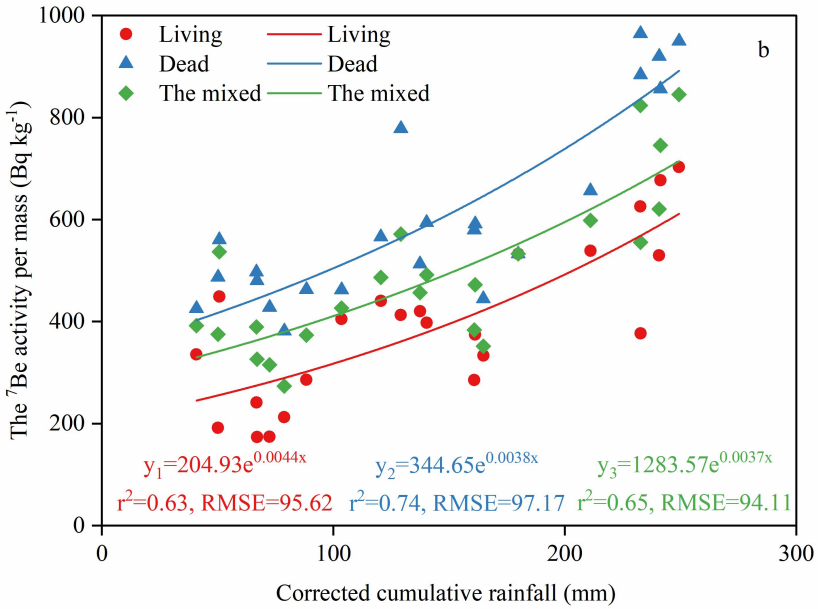


About 60.4% of rainfall occurred during the summer months (July to September), with a prominent seasonality

Results

- The ^{7}Be activity of plants is a dynamic value that decays with time, theoretically resulting in a discrepancy when directly analyzing the relationships between the ^{7}Be concentration in plants and cumulative rainfall.
- Corrected cumulative rainfall is more suitable than simply cumulative rainfall for confirming the correlation between ^{7}Be activity and precipitation.





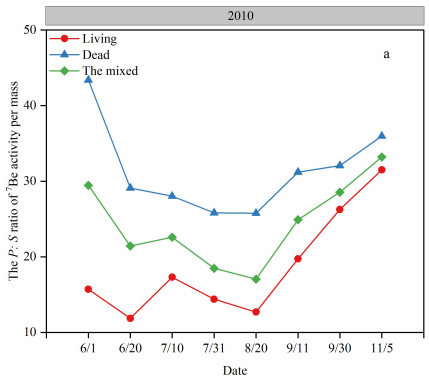
Results

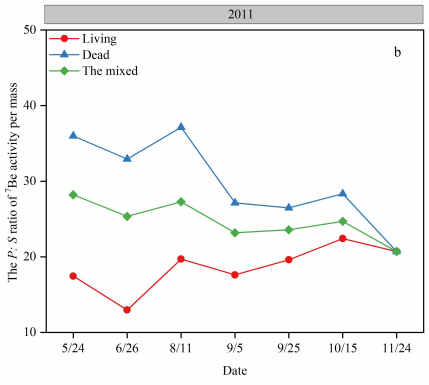
Plant types	Variable	Activity per mass					Activity per area				
		Coefficient	r^2	P	PSS*	TSS	Coefficient	r^2	P	PSS	TSS
The Living	Constant	238.26	0.59	0.00			-36.75	0.78	0.00		
	Dry biomass	-653.04		0.88	1.80	766670.94	270.60		0.00	0.61	44921.74
	Decayed cumulative precipitation	2.12		0.92	171067.41		0.46		0.00	211375.52	
The Dead	Constant	297.75	0.60	0.00			-68.32	0.89	0.00		
	Dry biomass	11.06		0.94	8403.26	1028102.74	637.97		0.00	0.13	51524.13
	Decayed cumulative precipitation	2.21		0.00	210690.56		0.46		0.00	242442.55	
The mixed	Constant	250.05	0.53	0.00			-113.20	0.81	0.00		
	Dry biomass	-0.87		0.99	1110594.24	848356.29	512.50		0.00	0.70	184099.11
	Decayed cumulative precipitation	1.74		0.00	280529.88		0.80		0.00	289824.47	

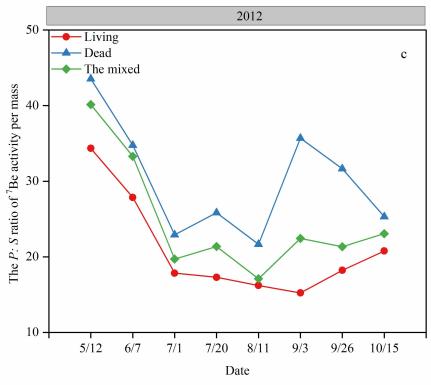
Noted: *PSS, partial sum of squares for each variable; TSS, the total sum of squares for the multiple regressions.

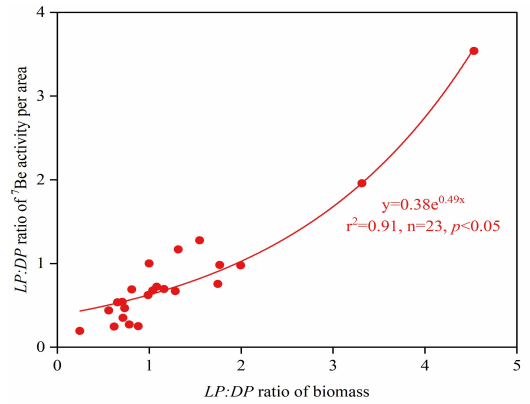
^{7}Be activity in plants was significantly positively correlated with corrected cumulative rainfall and dry biomass, but had no significant correlation with vegetation coverage

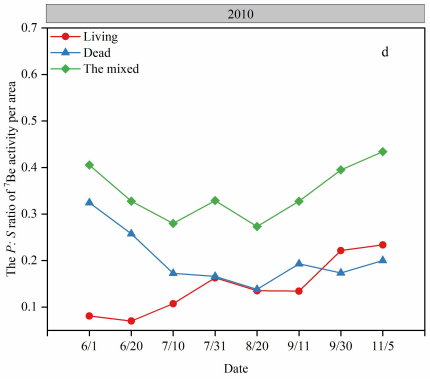
Results

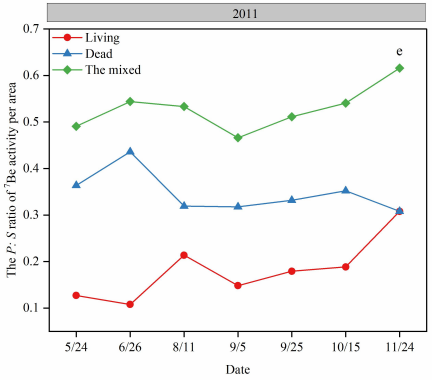


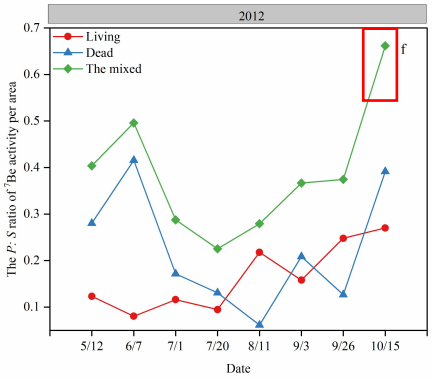


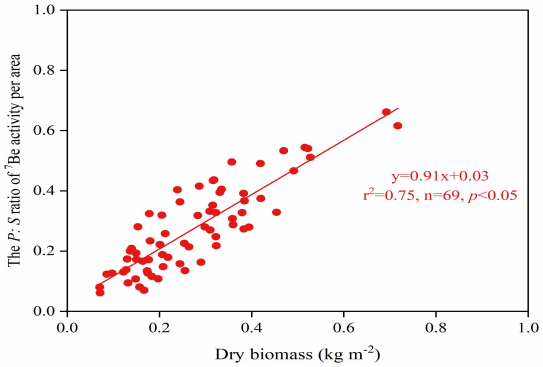












- Up to 66% of the ^{7}Be concentration on slope was intercepted by plants per unit area
- The more living plants on the vegetation-covered slope, the more important role they play in the uptake and retention of ^{7}Be

Discussion

- The accumulation of ^{7}Be is higher in leaves than stem ⇨ Leaves intercept much of the rainfall with a large surface area exposed to the air
- ^{7}Be activity increases from June to September and decreases from October to November ⇨ High precipitation and deposition fluxes, accompanied by growth of plants
- Precipitation accounted for the largest contribution to the accumulation of ^{7}Be in plants ⇨ Decayed ^{7}Be in rainfall should be carefully considered

Discussion

➢^{7}Be activity on the slope intercepted by plants was up to 66%, of which 7%~31% were intercepted by live plants and 6%~44% were intercepted by dead plants

➢The interception and absorbption of plants (especially dead plants) must be carefully considered when using ^{7}Be as a sediment tracer of soil erosion on slopes with vegetation cover

➢The deposition of ^{7}Be is first intercepted and absorbed by plants instead of soil, and the effect of plants to ^{7}Be distribution in the soil profile was not considered in the current modified model

Conclusion

The accumulation of ^{7}Be is significantly higher in leaves than stems.

Precipitation accounted for the largest contribution to the accumulation of ^{7}Be in plants, followed by plant growth, species and parts.

Plants accounted for ^{7}Be interception on slope up to 66%. The interception of living plants increases with the accumulation of rainfall and biomass together.

^{7}Be in plants is of great significance for total ^{7}Be on the slope, and is controlled by precipitation, growth status and plant characteristics.

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THANKS FOR YOUR TIME AND ATTENTION

Presented By Xuantian Li