Buttresses promote rainforest diversity

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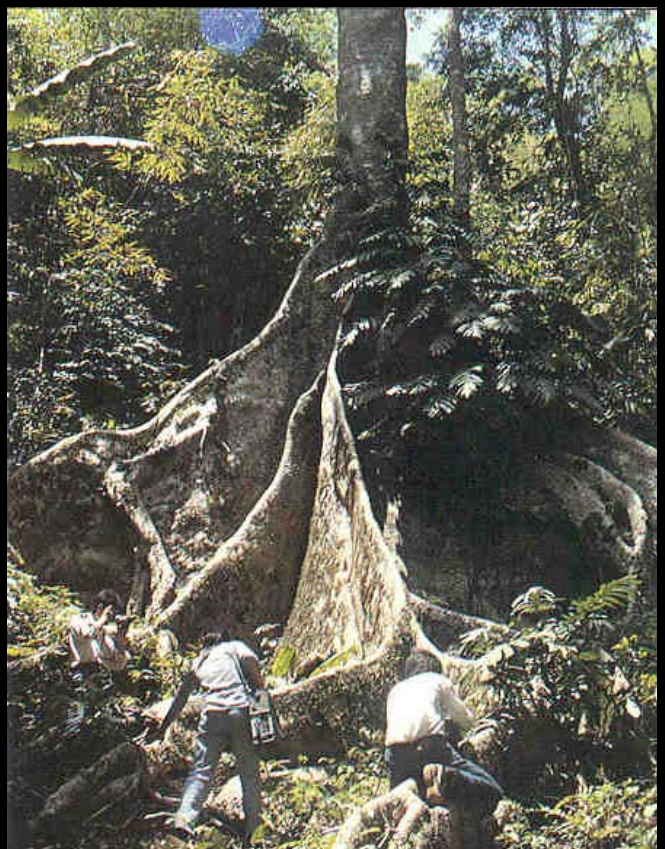
Niche Based Rainforest Diversity Maintenance

基于生态位的热带雨林多样性维持机制

- 短时间尺度：生境多样性促进物种多样性；
- 长时间尺度：生境多样性促进物种分化和新物种的形成；
- 生物与环境具有交互作用。

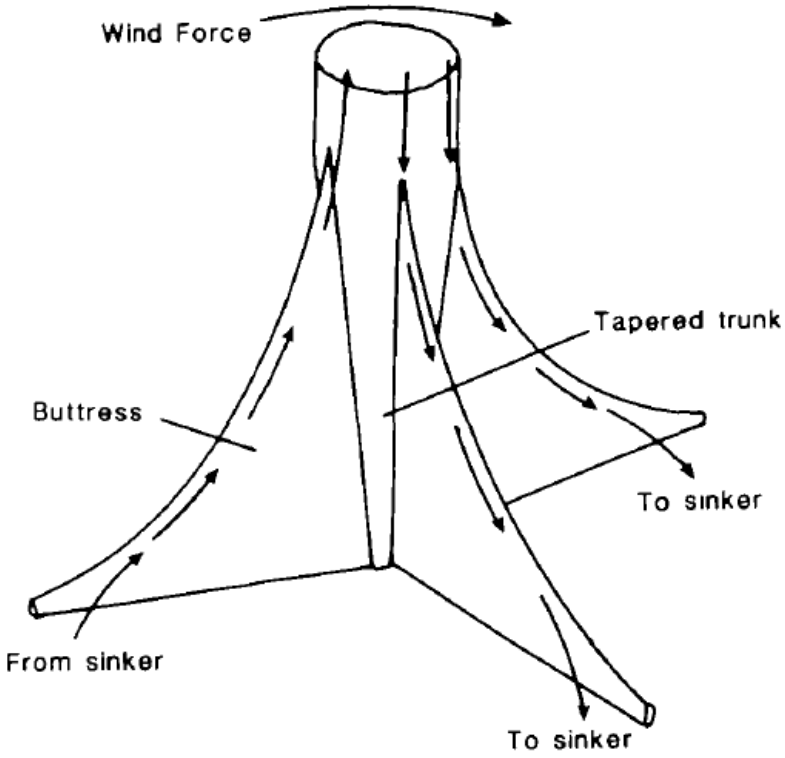
热带雨林中的板根

Buttresses in Rainforest



单向作用力假说
Unidirectional Force Hypotheses

- 季风
- 陡坡
- 林窗



Smith, 1972, Warren et al, 1988, Yong and Hubbell, 1991, Ennos, 1993,

热带土壤诱导假说 (Richards, 1996)
Tropical soil induced hypothesis

- 土壤土层薄
- 营养匮乏
- 透气性差

板根的功能
Function of Buttresses

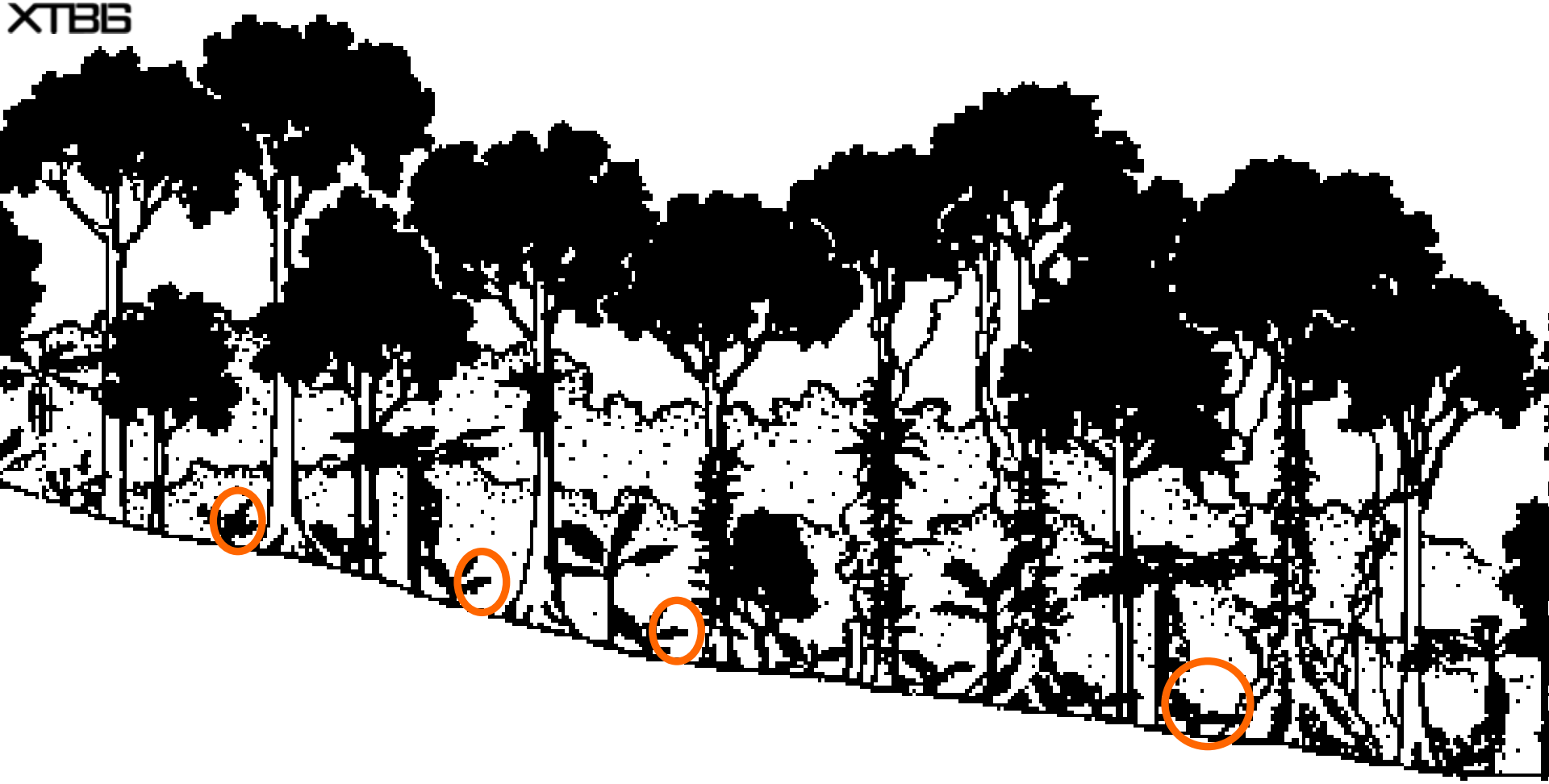
- 树木的支撑结构
- 截流地表径流
- 分流树干流
- 两爬动物栖息地
- ?

Leaf-tail gecko

Litter trap

Barringtonia macrostachya

XTBG



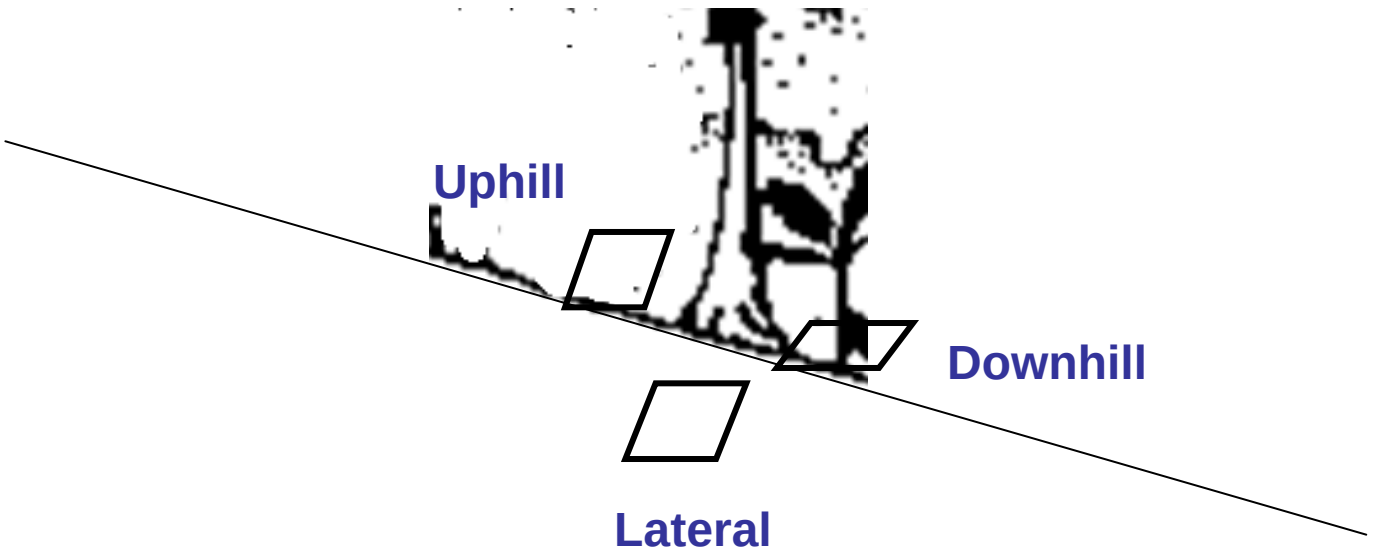
Holding areas formed by buttresses

Hypothesis

Buttresses may:

- Regulate soil moisture;
- Accumulate leaf litter;
- Improve nutrient status; and
- Promote seedling diversity.

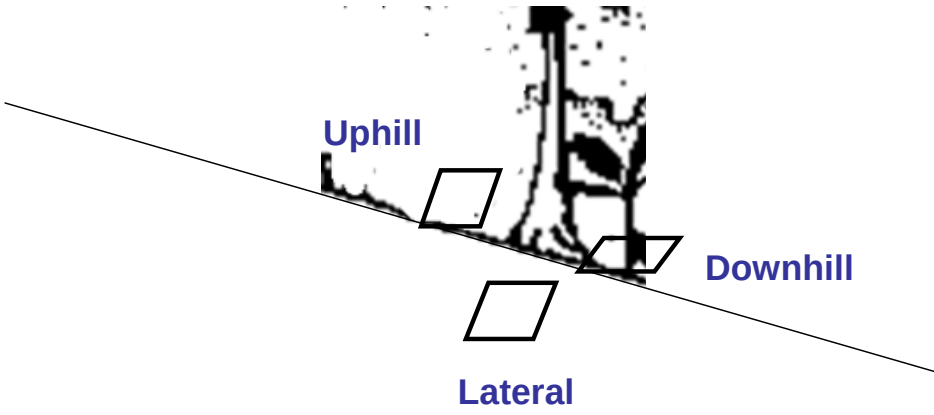
Study design

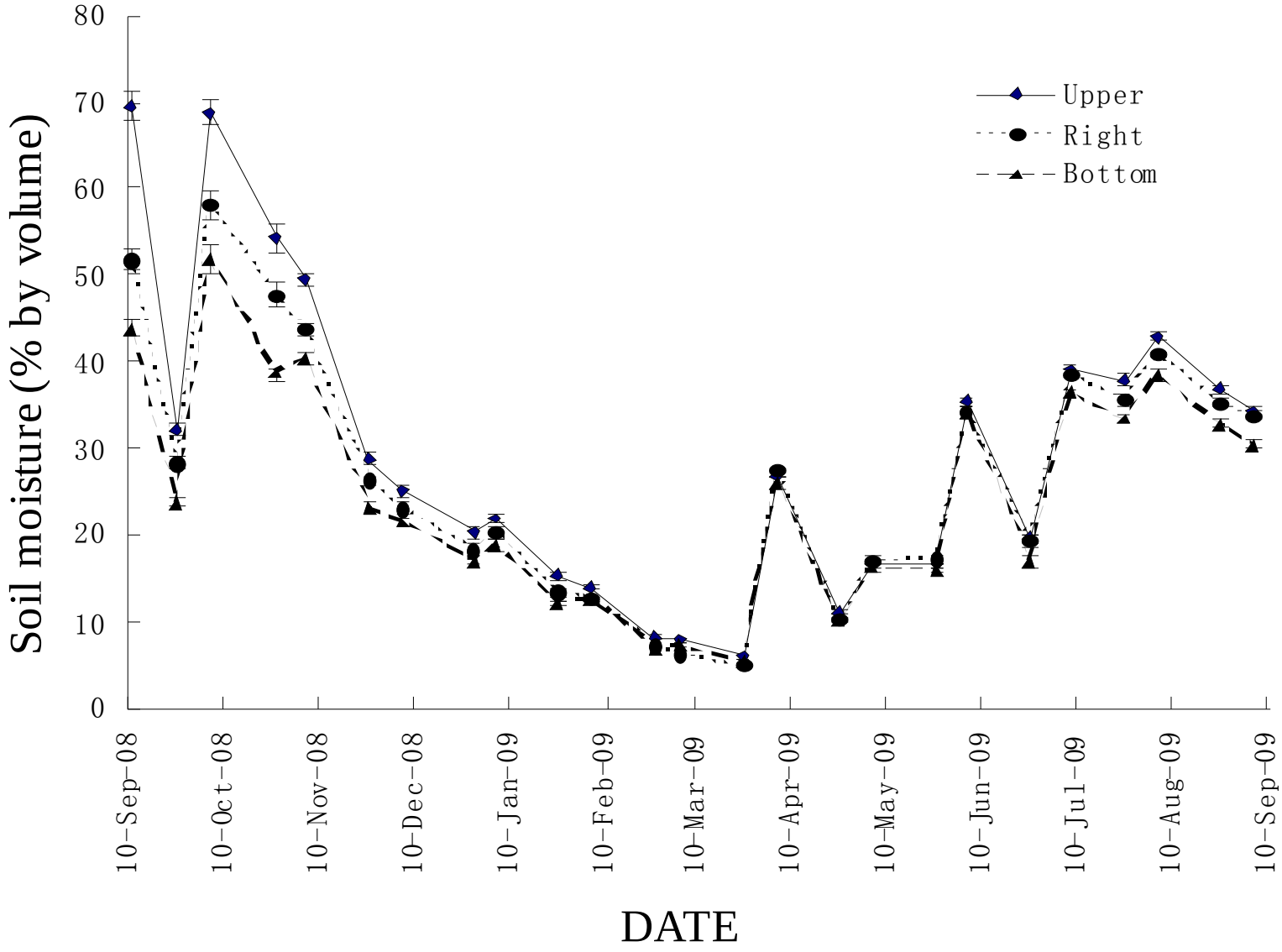


Data collecting locations at 20 buttressed trees

Data collecting

- Soil moisture (TDR, twice a month);
- Soil nutrients (N, P, K);
- Ground leaf litter; and
- Seedling survey.

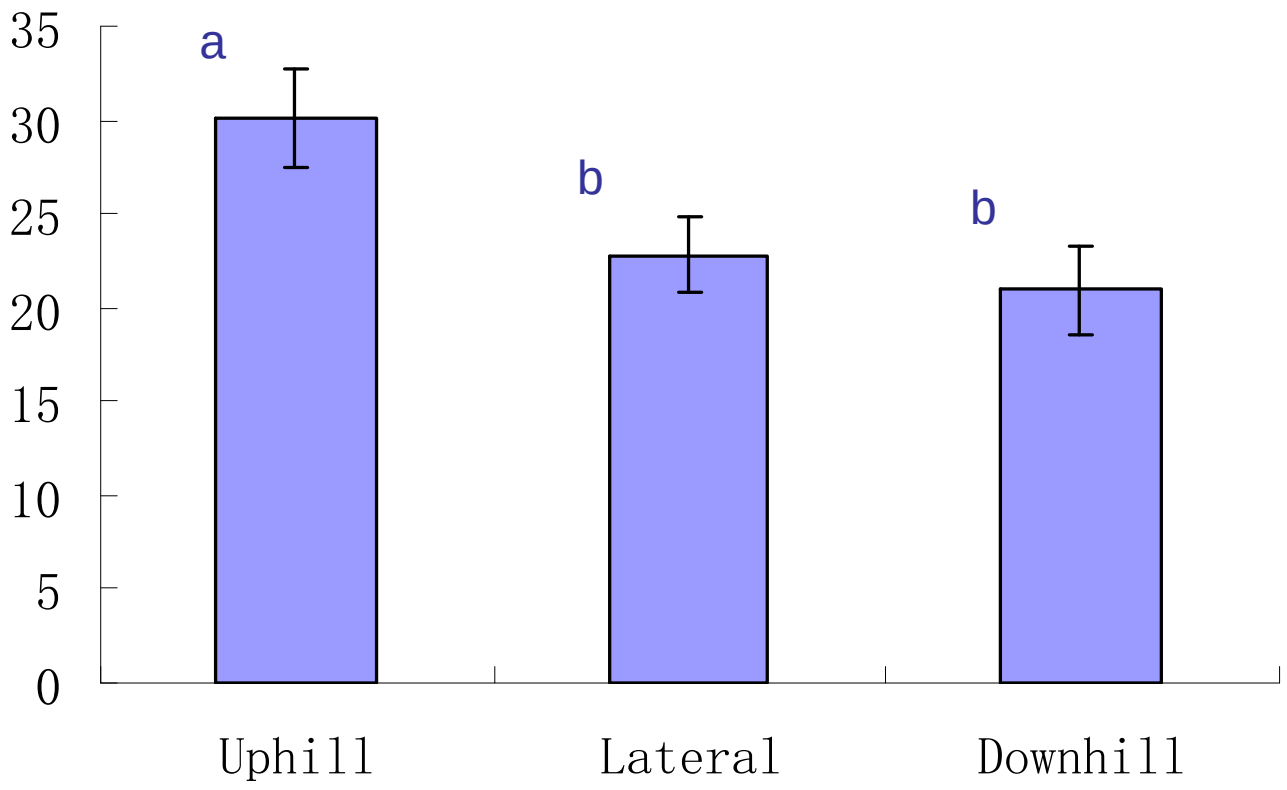




Changes in soil moisture over time at different positions near buttresses in a tropical rainforest (Repeated measure of ANOVAs, $P<0.001$)

Table 1 Regression model of the relationship between preceding monthly and weekly rainfall and the contrast in soil moisture among different locations near buttresses.

Comparison pairs	b0	b1	R^2	F	P
Monthly rainfall					
Up vs Down	3.003	0.061	0.739	45.215	<0.001
Up vs Lateral	1.756	0.035	0.700	37.349	<0.001
Down vs Lateral	1.248	0.027	0.643	28.840	<0.001
Weekly rainfall					
Up vs Down	5.596	0.168	0.328	7.822	0.013
Up vs Lateral	3.232	0.095	0.309	7.158	0.017
Down vs Lateral	2.365	0.073	0.288	6.487	0.022



Comparison of ground leaf litter accumulation at different locations near buttresses, different letters above the bars indicate significant difference as detected by a ANOVA.

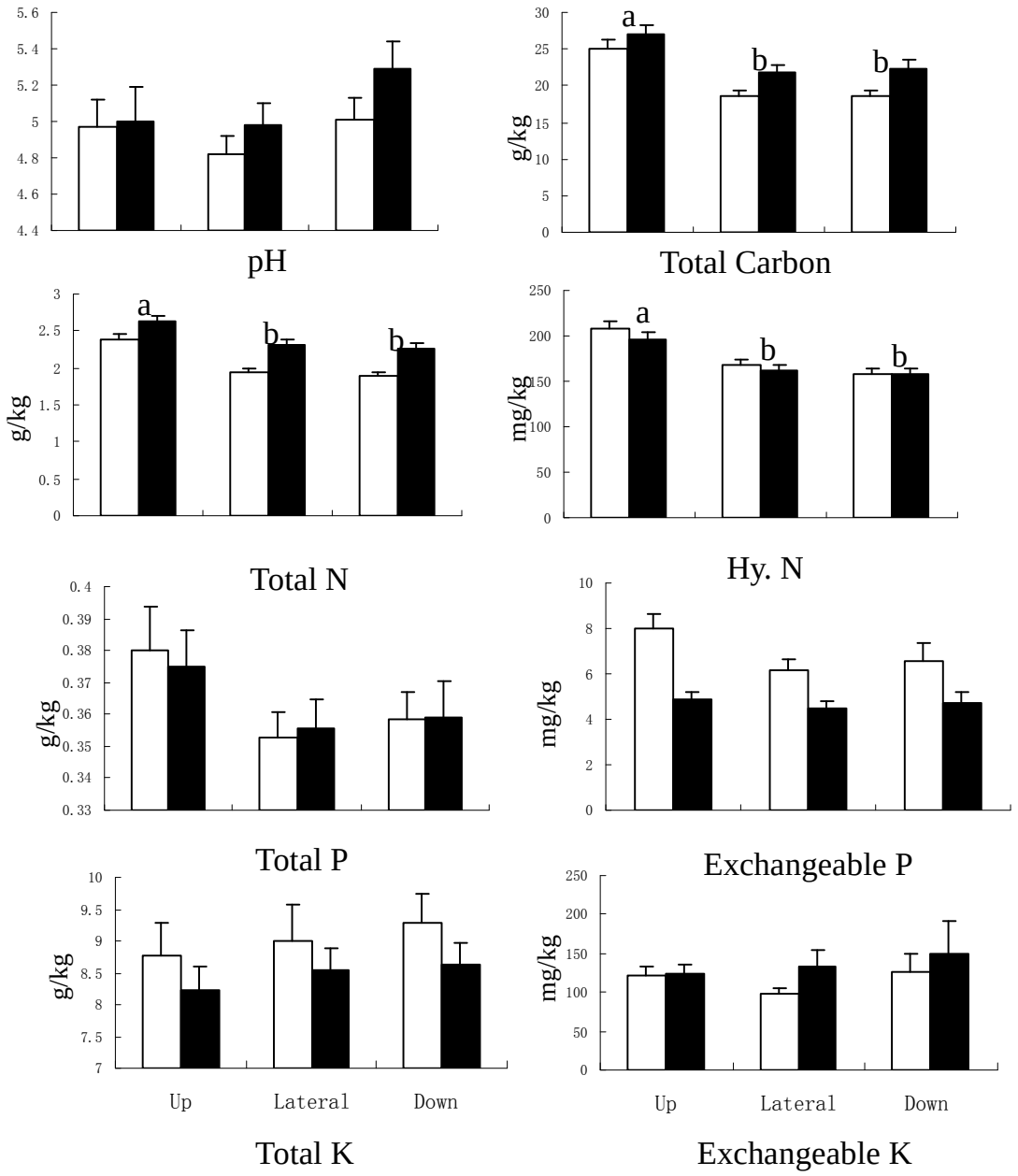


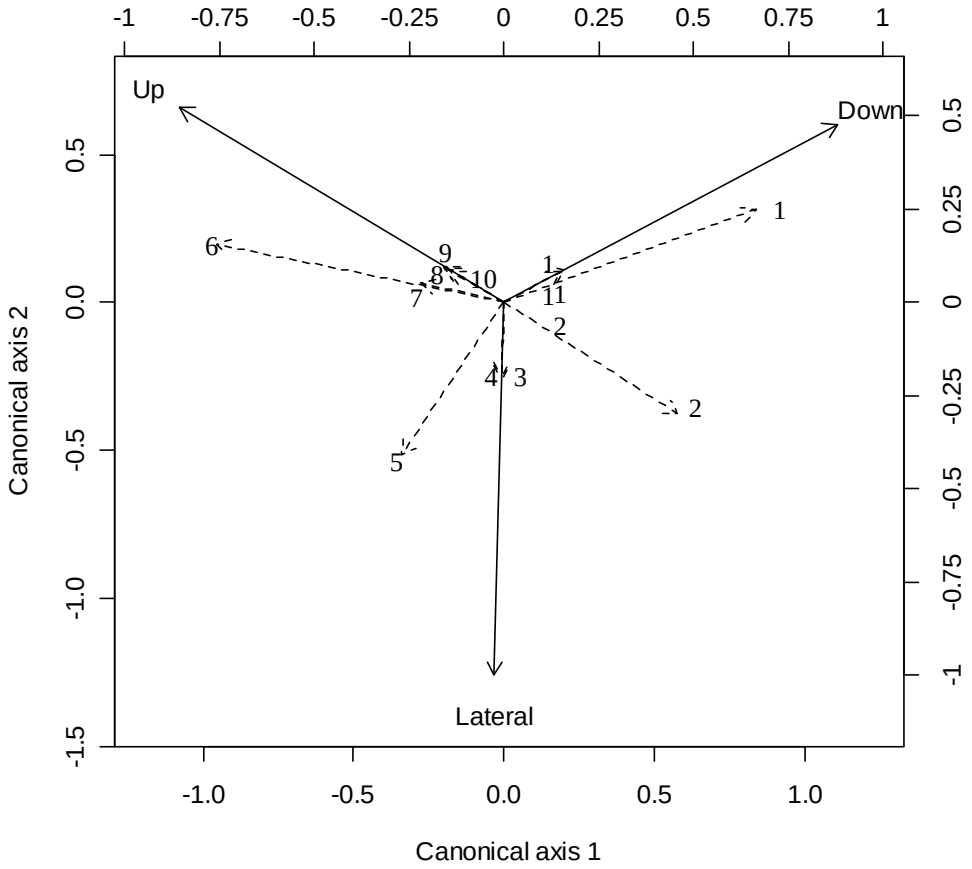
Fig 2 Distribution of soil nutrients at different locations near the buttresses of trees during the rainy season (white bars) and dry season (black bars)

XTBG

Comparison of seedling density, richness and diversity (mean, S.E.) among different locations near the buttress of trees in a tropical rainforest

(ANOVA, Tukey's HSD test, $P<0.05$)

	Number of seedlings	Number of species	Shannon Index
Up	7.65 (1.69)[a]	4.85(0.51)[a]	3.27
Lateral	4.65 (0.49)[ab]	3.15(0.25)[b]	3.26
Down	4 (0.50)[b]	3.05(0.39)[b]	3.04



Canonical Redundancy Analysis (RDA, R-square = 0.044, F = 1.546, P =0.018) of seedling distribution on the basis of the abundance of seedlings. Biplot vectors (dash line) show the trends in increasing abundance for species in relation to the positions (Solid line) to buttressed trees in ordination space. 1. *Randia yunnanensis* Hutch.; 2. *Drypetes cumingii* (Baill.) Pax & K. Hoffm.; 3.*Ficus subincisa* J. E. Smith ; 4. *Ventilago calyculata* Tul.; 5. *Pseuduvaria indochinensis* Merr.; 6. *Barringtonia macrostachya* (Jack) Kurz; 7. *Pavetta arenosa* Lour. 8. *Antidesma montanum* Bl. 9. *Morinda angustifolia* Roxb. 10. *Phoebe lanceolata* (Wall. Ex Nees) Nees; 11. *Canarium tonkinense* (Leenh.) Engl.; 12. *Dysoxylum densiflorum* (Blume) Miq.

Conclusion

- **Buttresses contribute to habitat heterogeneity**
- **Buttresses promote seedling diversity**

Future directions

- Decomposition near buttresses;
- Buttresses shape light environment;
- Soil seed bank; and
- Soil dwelling arthropods

中国科学院知识创新方向性项目 (KZCX2-YW-430)资助