Soil Warming accelerating Nitrogen Mineralization and Heterotrophic Respiration in a Sub-tropical Evergreen Broad-leaved Forest in Ailao Mountains, SW China

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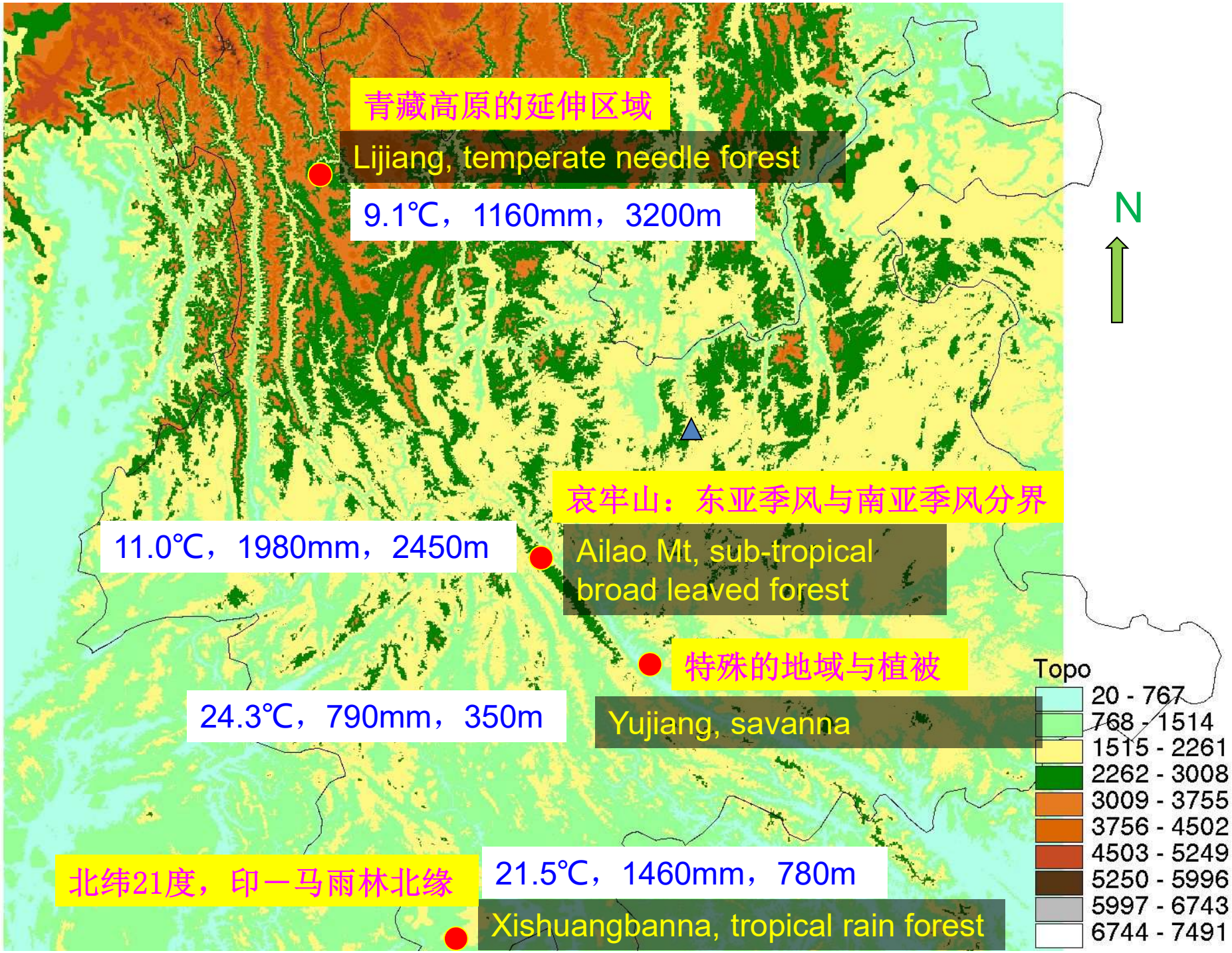
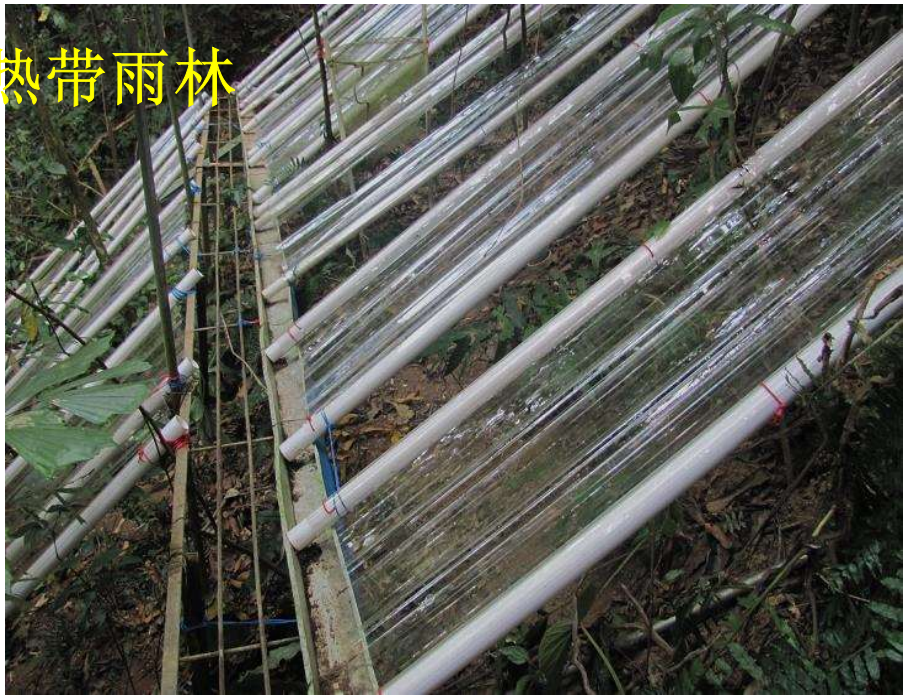
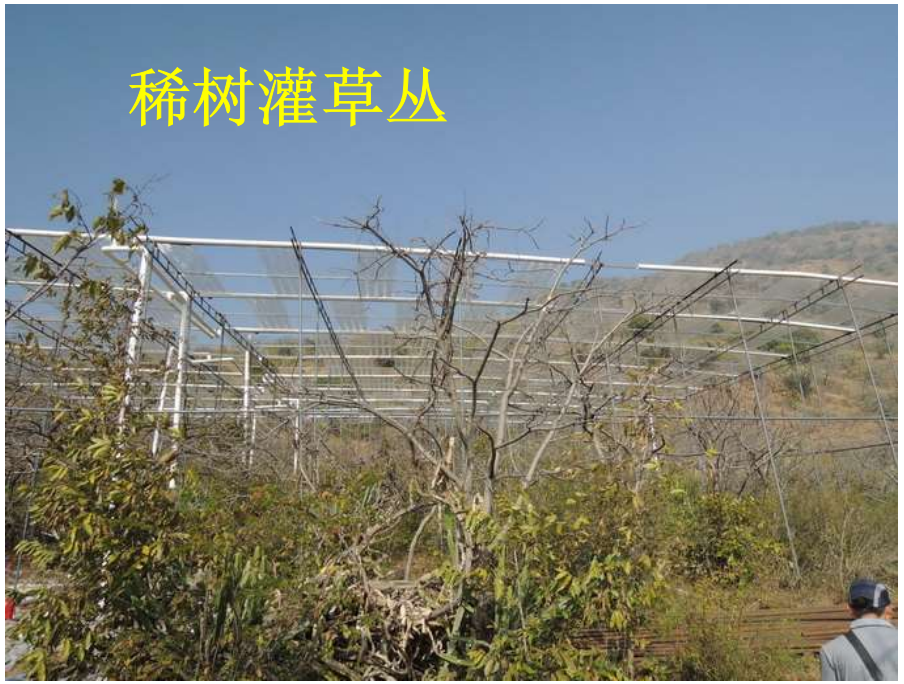
Study Site

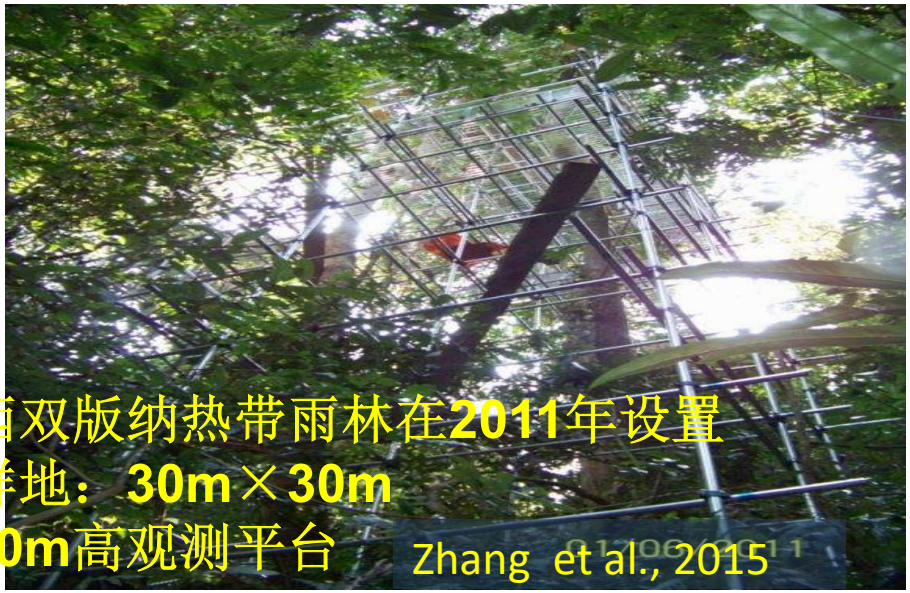
Yunnan province

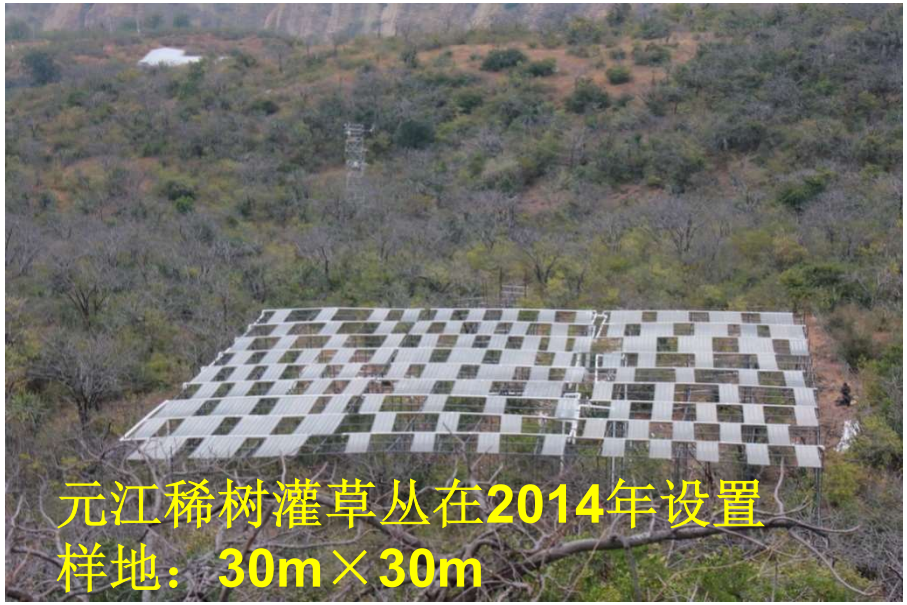

青藏高原的延伸区域
Lijiang, temperate needle forest
9.1℃，1160mm，3200m
N
哀牢山：东亚季风与南亚季风分界
11.0℃，1980mm，2450m
Ailao Mt, sub-tropical broad leaved forest
特殊的地域与植被
24.3℃，790mm，350m
Yujiang, savanna
Topo
20 - 767
768 - 1514
1515 - 2261
2262 - 3008
3009 - 3755
3756 - 4502
4503 - 5249
5250 - 5996
5997 - 6743
6744 - 7491
北纬21度，印—马雨林北缘
21.5℃，1460mm，780m
Xishuangbanna, tropical rain forest

Rainfall reduce in savanna, throughfall reduce in tropical rain forest

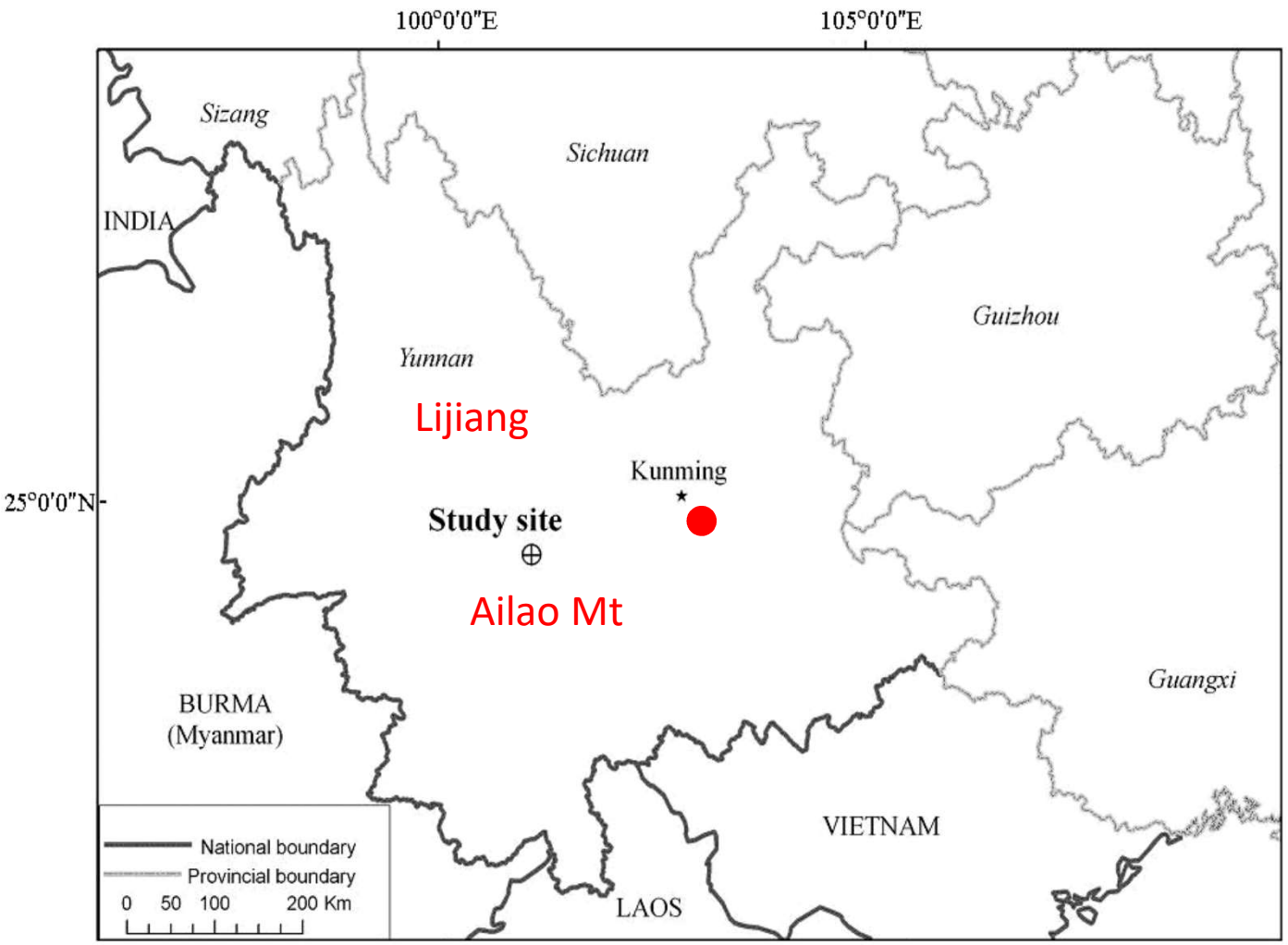








Location of soil warming sites

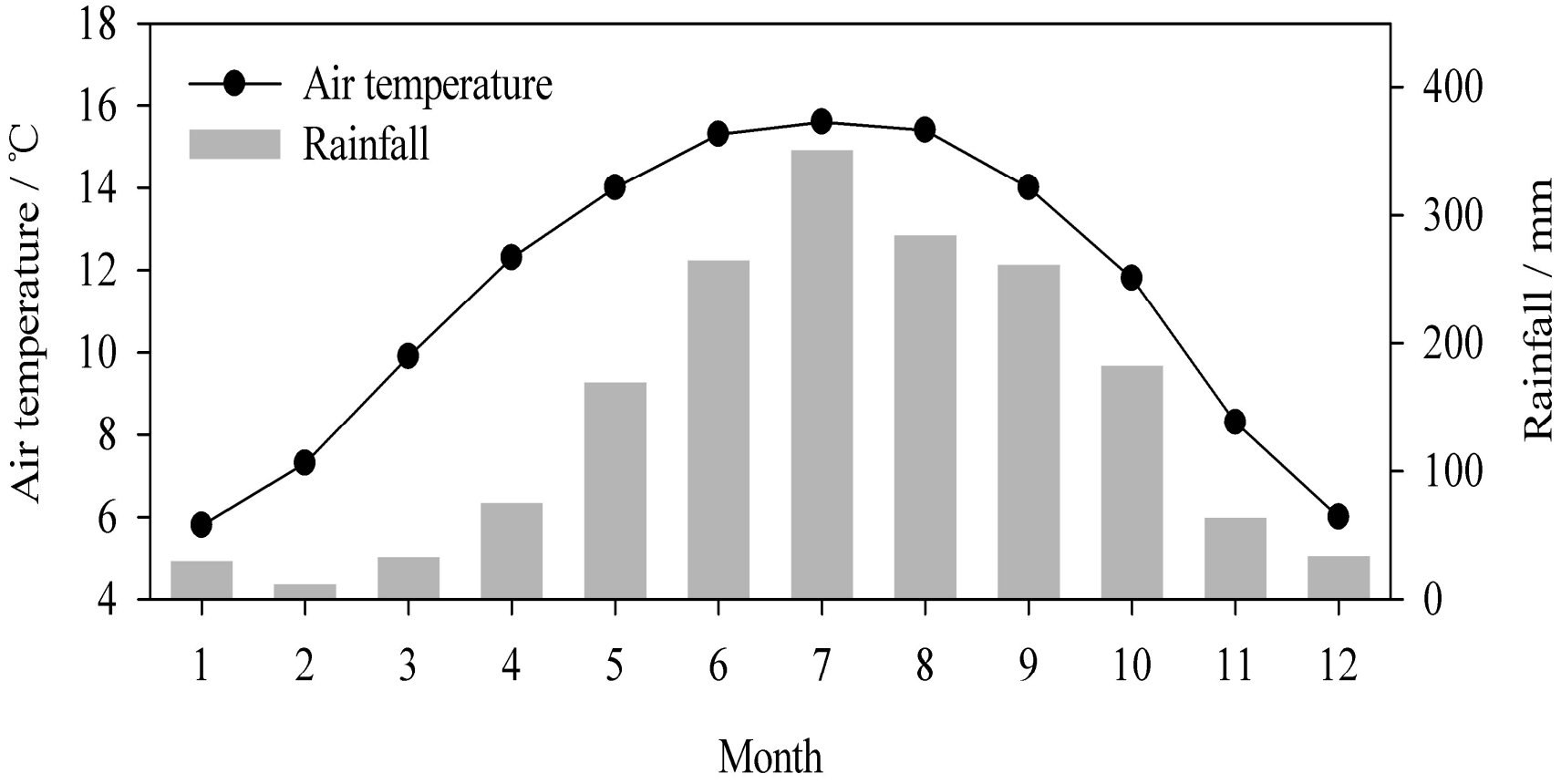


Sub-tropical broad leaved forest in Ailao Mountains

Temperate needle leaved forest in Ljiang

3200m

Monthly air temperature and rainfall in Ailao Mountains



Sub-tropical forest site in Ailao Moutains

- (24° 32′N, 101° 01′E)
- **Elevation： 2480m**
- **MAT 11.3℃**
  Rainfall: 1931.9 mm，85% occured in rainy season.
- **Dominant species:**
- 木果柯(*Lithocarpus xylocarpus*)
- 硬壳柯(*Lithocarpus chintungensis*)
- 变色锥(*Castanopsis wattii*)
- 箭竹(*Sinarundinaria nitida*)

Physical and chemical properties of soil (0-15cm) in Ailao Mountains

- Bulk density (g/cm3) 0.528
- Porocity (%) 73.06
- OM (%) 13.6
- Total N (%) 0.4
- C/N 26.50
- pH_{H2O} 3.85

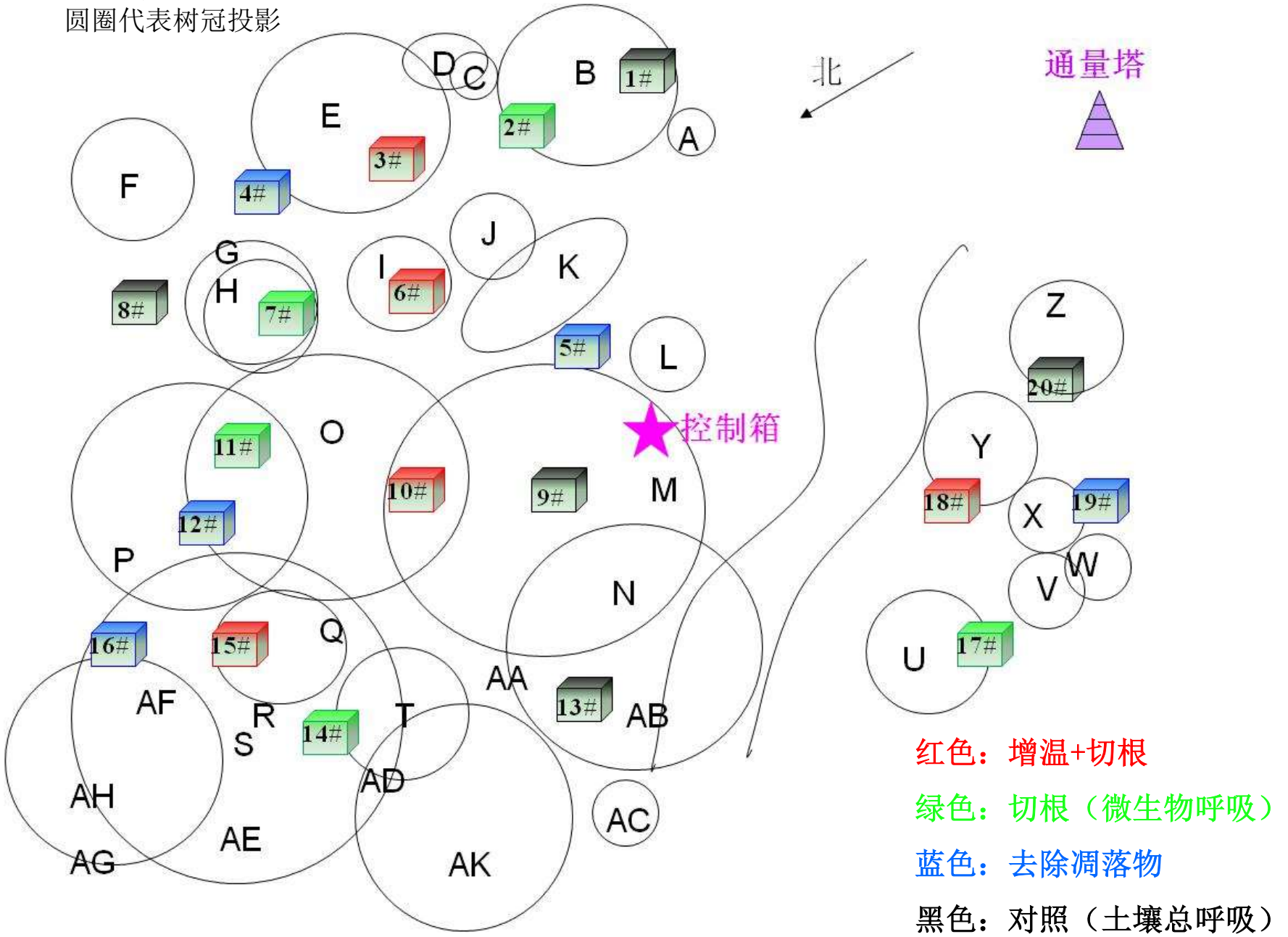
Soil warming experiment

Treatments:

control
trenching
trenching+warming
litter remove

哀牢山土壤增温人工控制实验气室配置示意

字母代表树的编号
圆圈代表树冠投影



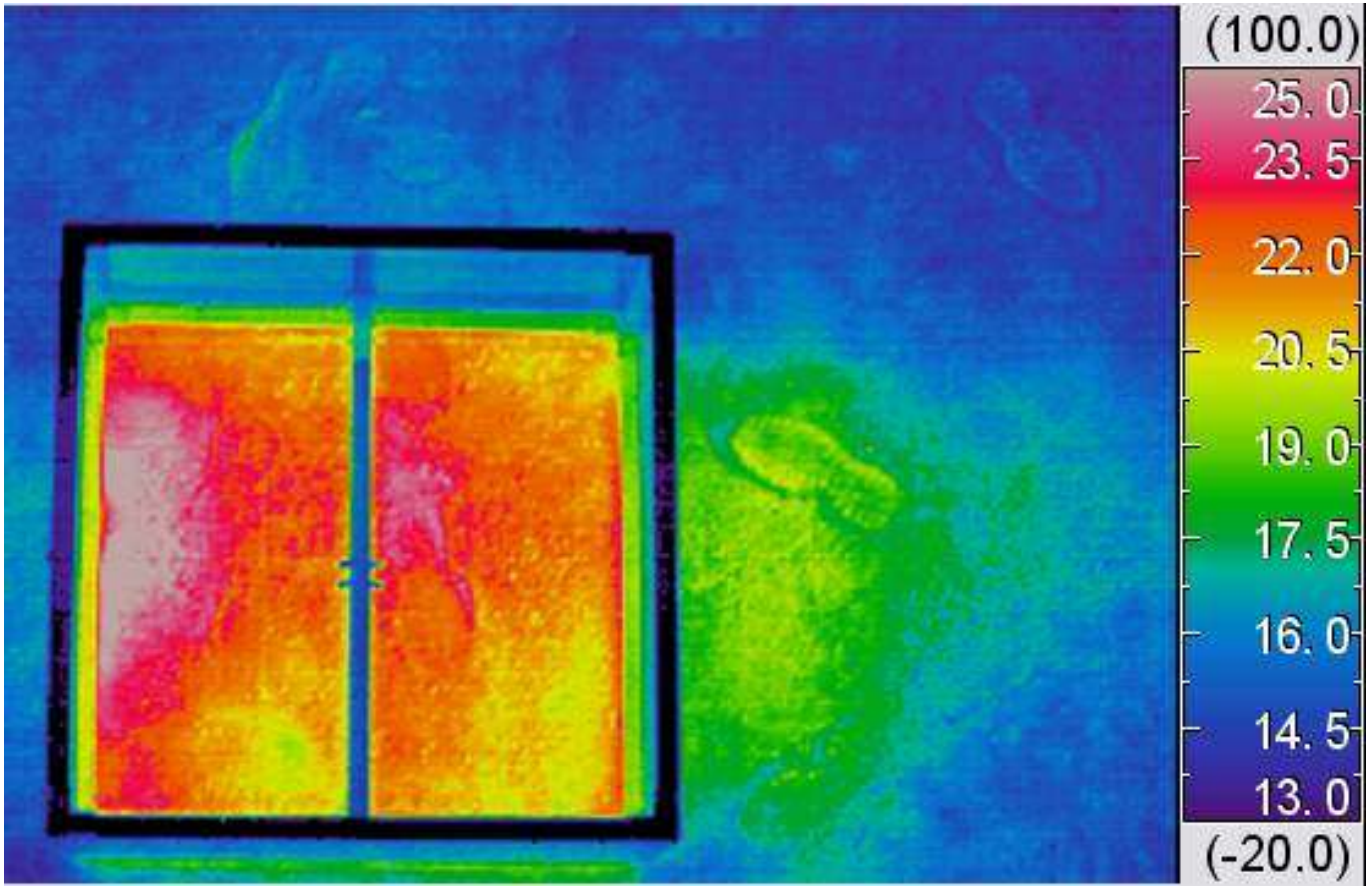
红色：增温+切根

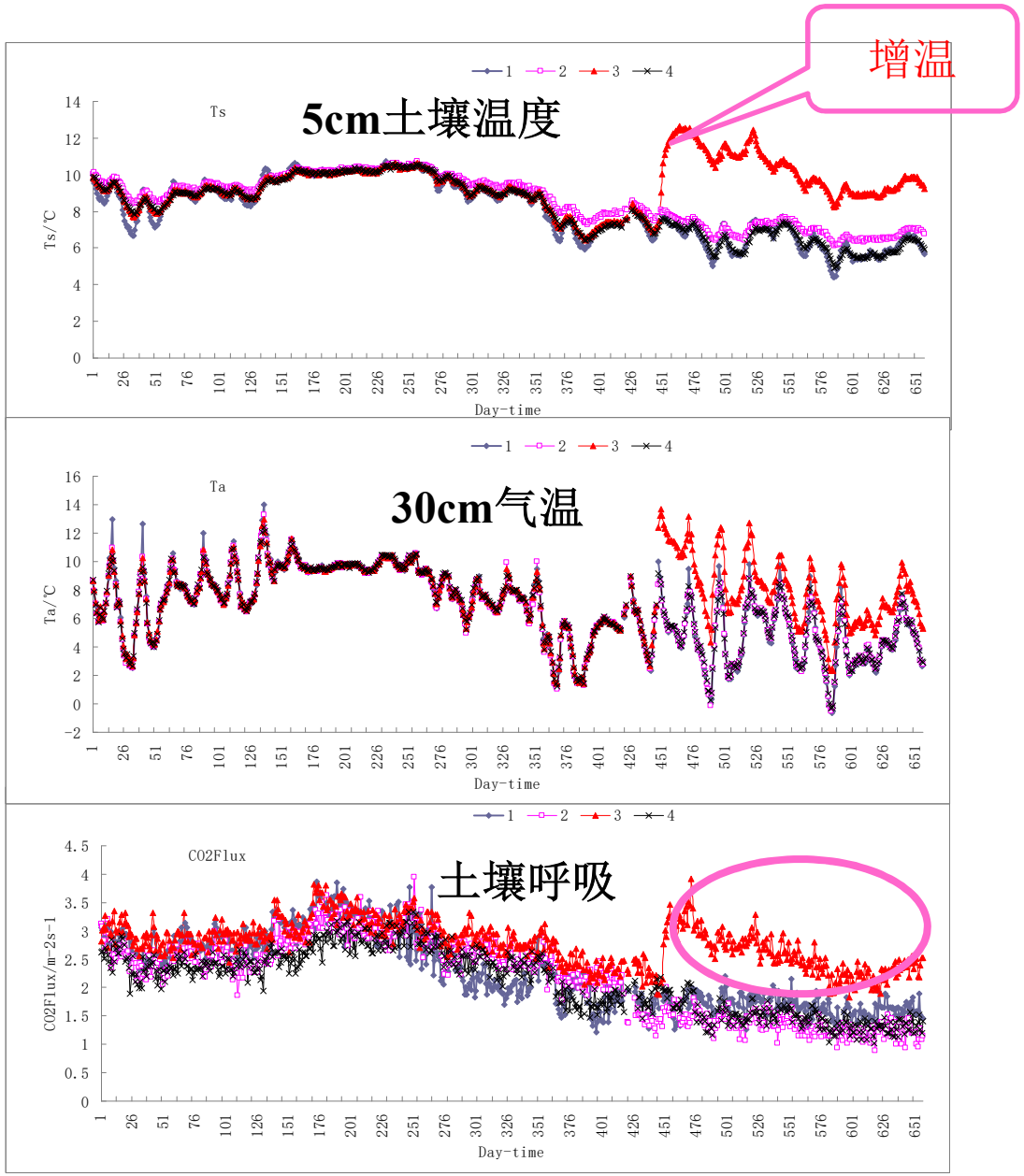
绿色：切根（微生物呼吸）

蓝色：去除凋落物

黑色：对照（土壤总呼吸）

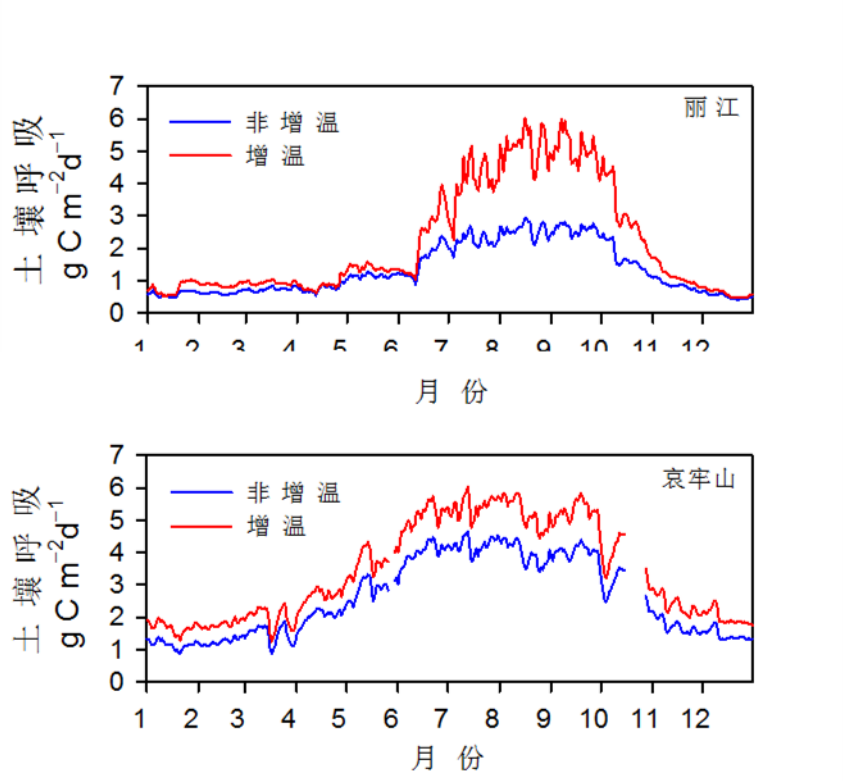
Thermal image of soil surface

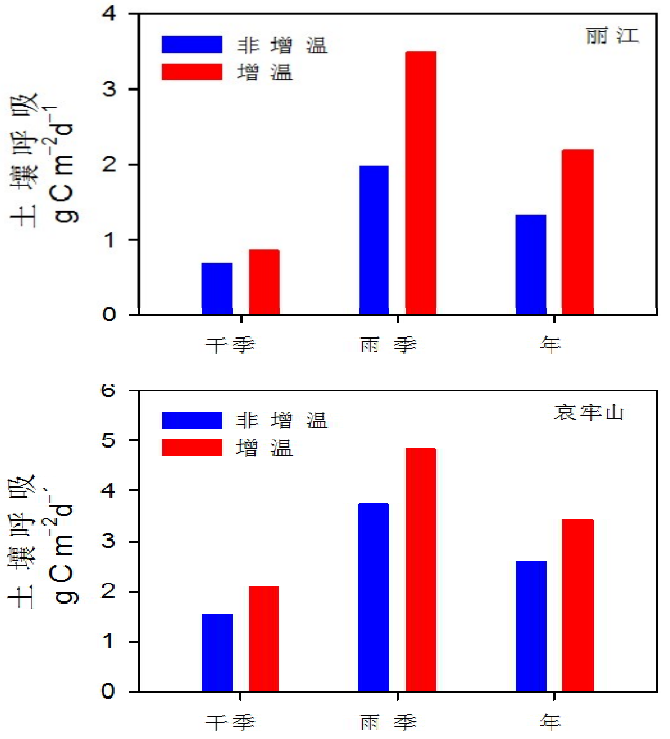




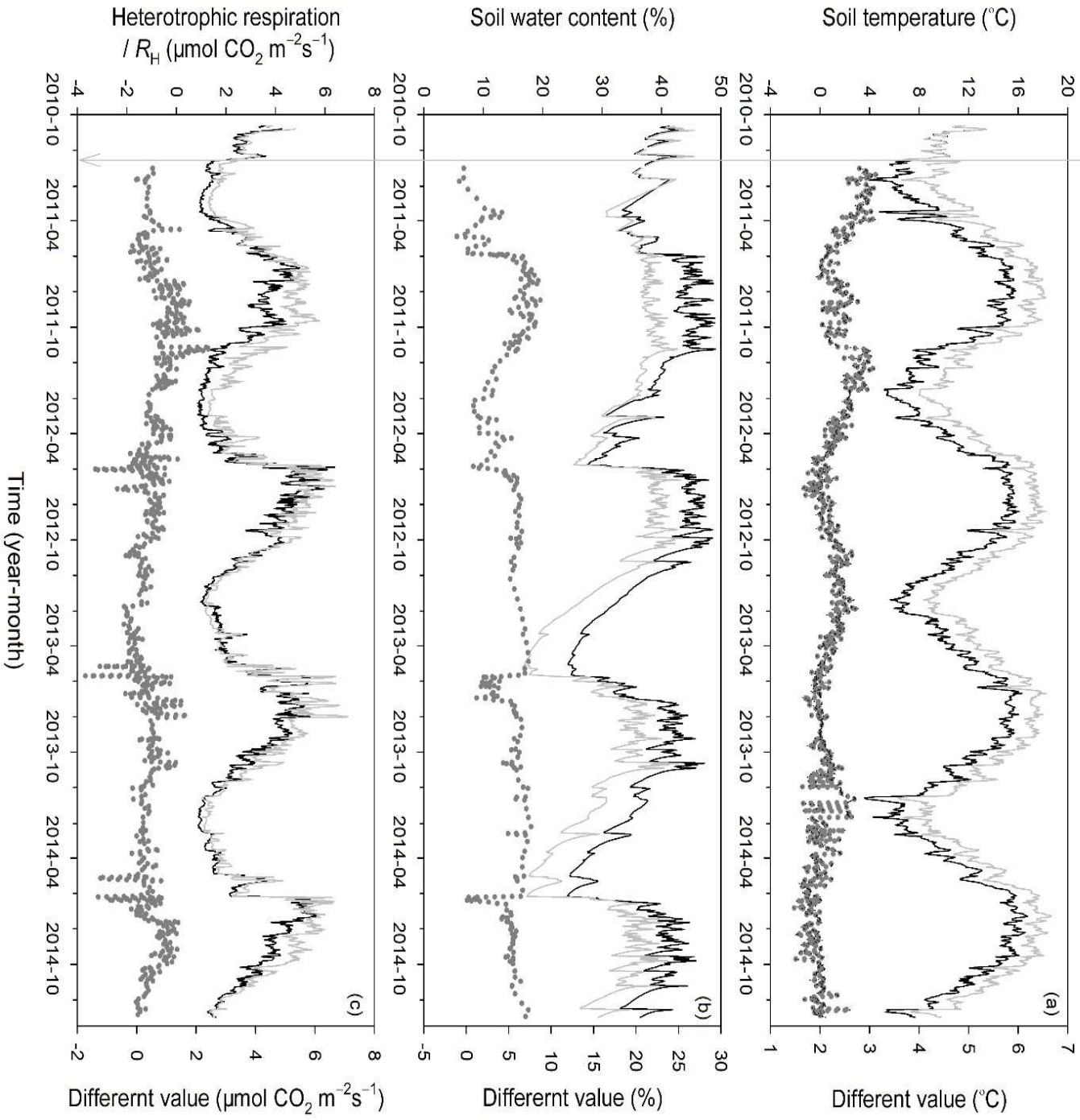
Soil warming experiment began in the end of 2010.

The effects of warming on SR

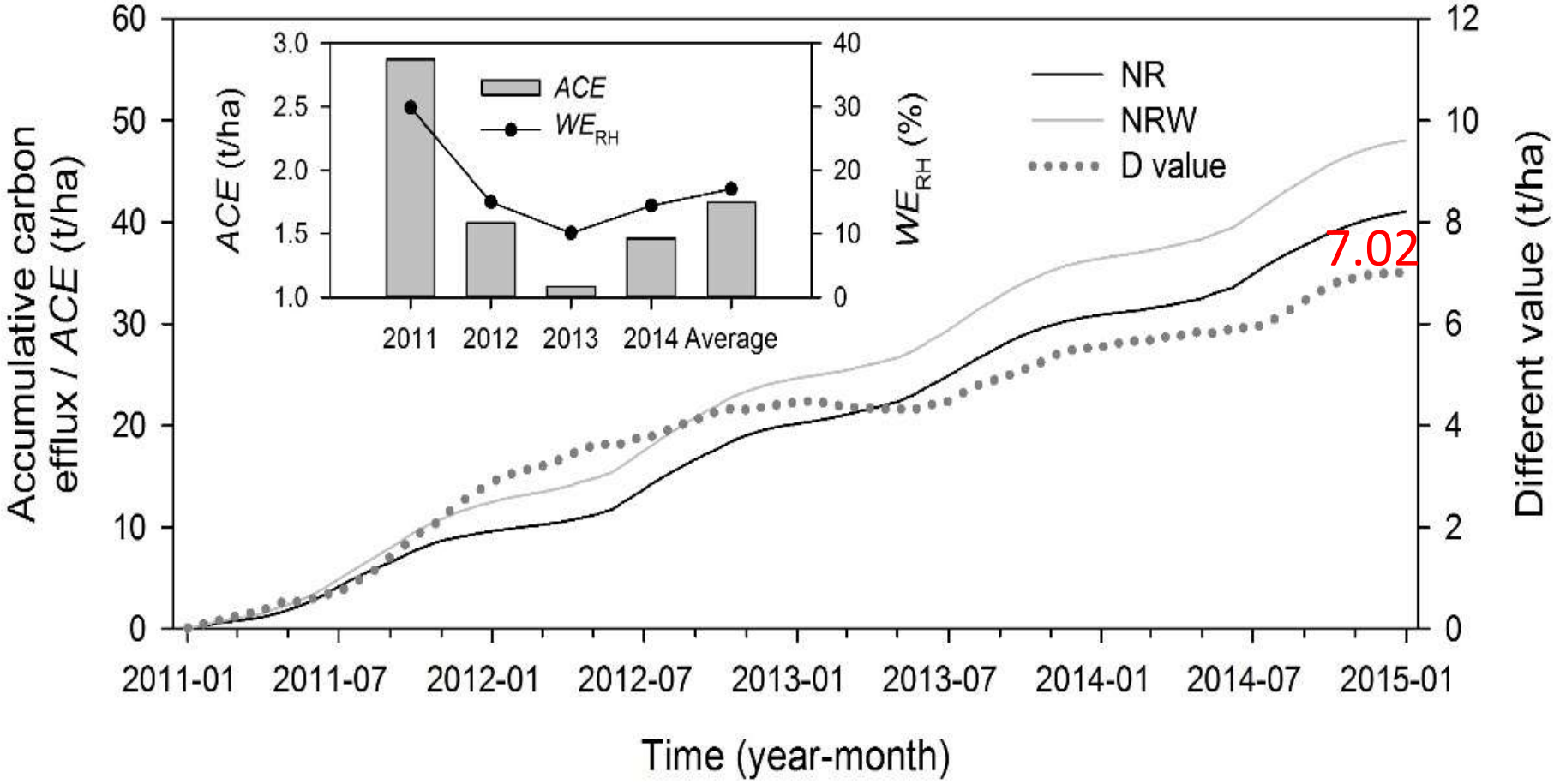




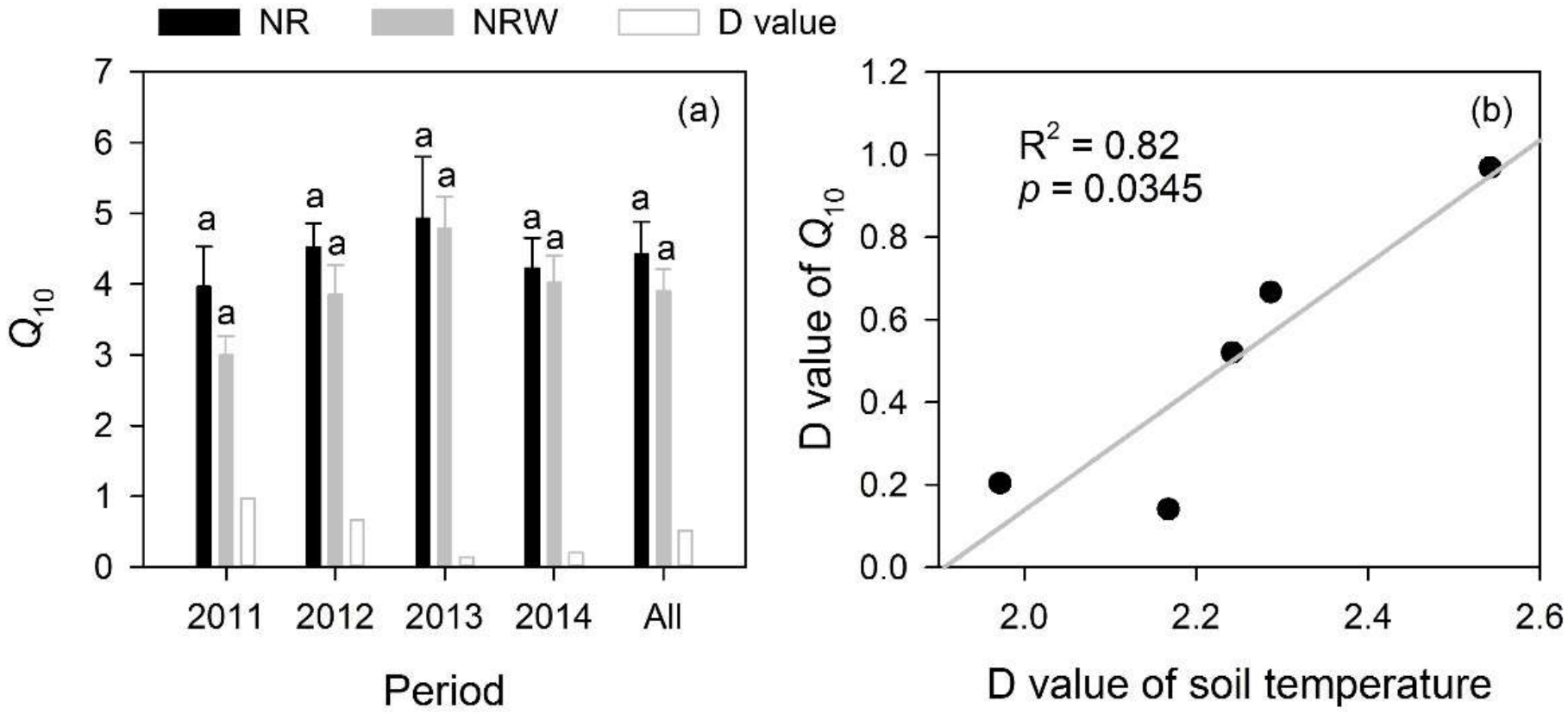
The effects of warming on soil temperature, soil moistue and SR In Ailao Mountains



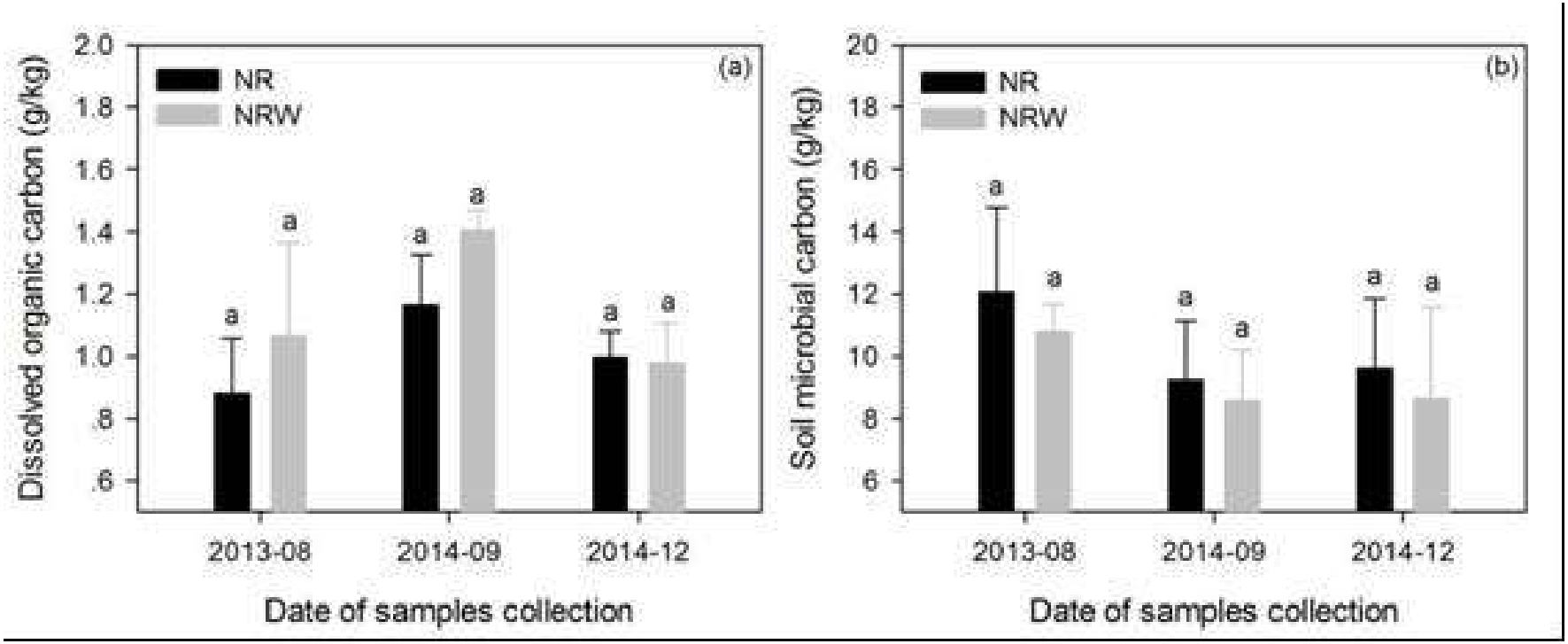
The effects of warming on accumulative carbon efflux In Ailao Mountains



Temperature sensitivities and their difference value (a),
the relationship between difference values of soil temperature and temperature sensitivity (b).
Ailao Mountains



The effects of warming on DOC (a) and MBC (b) in Ailao Moutains



The effect of soil warming on nitrogen mineralization in Ailao Moutains

Close-top incubation, 15cm

The effect of soil warming on nitrogen mineralization in Ailao Mountains

处理	干湿季节	矿化速率 ($mgN \cdot kg^{-1} \cdot 30d^{-1}$)			每公顷矿化量($kgN \cdot ha^{-1} \cdot 30d^{-1}$)			年净矿化量之和 ($kgN \cdot ha^{-1}$)
		NH4-N	NO3-N	NH4-N+ NO3-N	NH4-N	NO3-N	NH4-N+ NO3-N	
对照	干季	2.81	14.91	17.72	13.65	72.45	86.10	251.22
	湿季	1.87	32.13	33.98	9.11	156.14	165.12	
切根	干季	0.09	13.76	13.84	0.42	66.87	67.28	234.15
	湿季	2.45	31.94	34.34	11.89	155.22	166.87	
增温切根	湿季	5.53	16.06	21.59	26.88	78.04	104.91	268.29
	湿季	1.30	32.32	33.62	6.33	157.07	163.37	

Soil warming will increase nitrogen mineralization by 34.14 $kgN \cdot ha^{-1}yr^{-1}$.

Conclusions

Warming

- Increased soil temperature
- Reduced soil moisture
- Increased heterotrophic respiration
- Reduced temperature sensitivity
- Increased nitrogen mineralization

Future studies

- SR from deep soil
- Microbe
- Young and old soil carbon mineralization
- Soil enzyme
- C and N interaction
- ……


Thanks!