Wetland Carbon Dynamics in the Eastern Qinghai-Tibet Plateau

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PROBLEMS

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- Wetland Loss
- Degradation
- Desertification (670 ha/year)

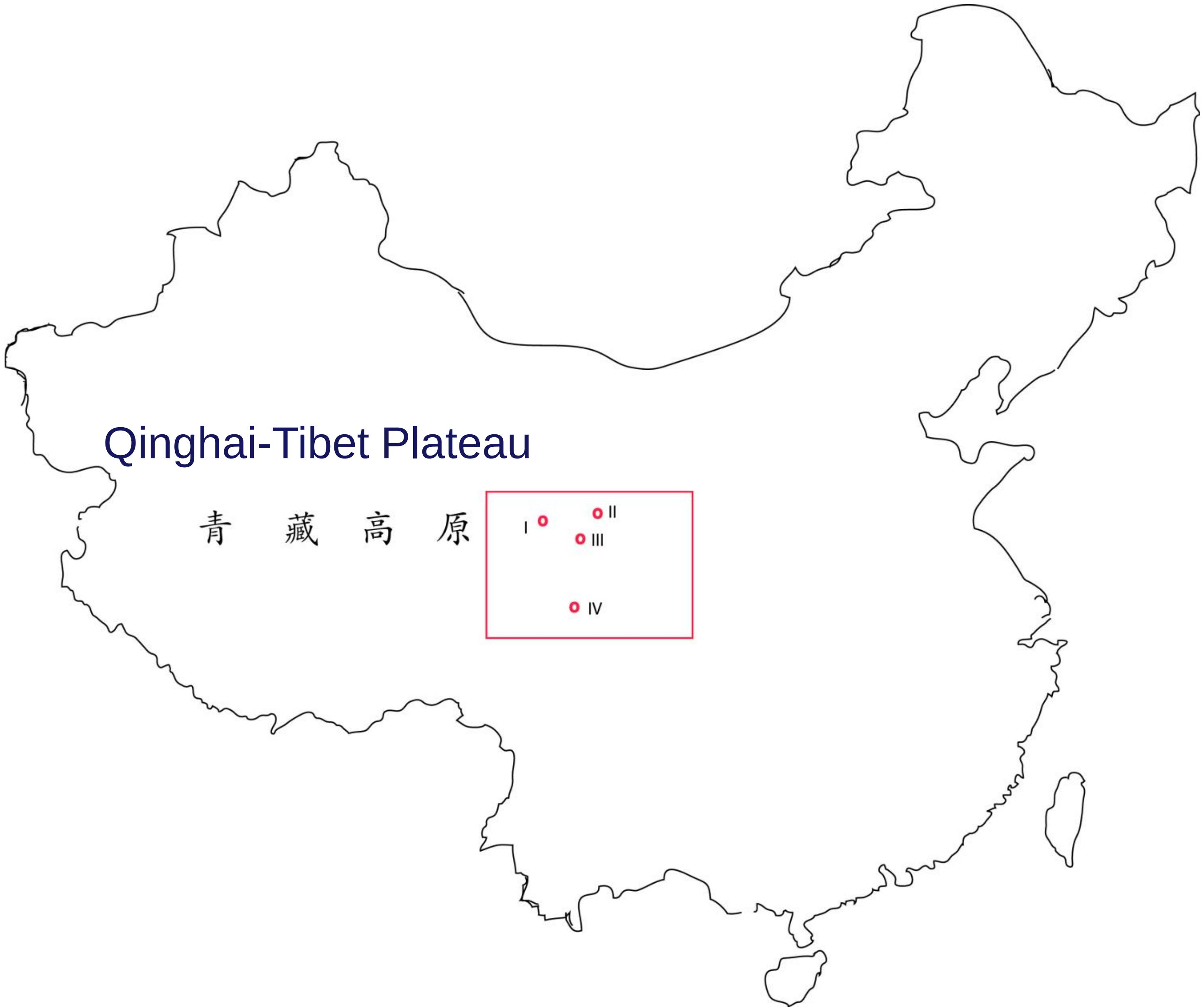
Importance of Wetlands in the Eastern Qinghai-Tibet Plateau

- Headwaters of Yangtze River and Yellow River basins
- Kidney of Plateau
- Ramsar Wetland (Rouergai Wetland)
- World Heritage (Jiuzhai Valley)
- Impact to Climate Change

OBJECTIVE

- To measure soil carbon, nitrogen and phosphorus for alpine natural and restored wetlands in the eastern Tibetan Plateau
- To investigate hydrologic dynamics from wetlands
- To understand if hydrology plays a key role for wetland carbon sink for restored area

Study Site



Study Site

Basin
Ramsar site
National park
Dam
City
International boundary
MONGOLIA
Lang
Wuyuan
Daqing
Houhehot
Baotou
BEIJING
Ordos
Bo Hai
Tengri Desert
Yinchuan
Qilian
Lüliang
Taiyuan
Yellow River
Fen He
Qinghai Hu
Xining
Yan'an
Jinan
Yellow River
Lanzhou
Linfen
Maqên Gangri
6,282 m
Xiqing
Tongchuan
Wei
Baoji
Luoyang
Anymaqing
Xi'an
CHINA
Bayan Khara
Qing Ling
250 km


Nanjing
Wuhan
Shanghai
Chongqing
China


Natural Wetland


Natural Wetland


Natural Wetland

Restored Wetland


Restored Wetland


Restored Wetland


Restored Wetland


草海
Grass Lake
རྩ་མཚོ།


宽叶香蒲
Typha latifolia
香蒲科香蒲属
水景观赏植物。
九寨沟国家级自然保护区

METHODS

- Hydrological time series data (1988-2008) were analyzed and modelled.
- Above- Below- ground biomass from dominated plant communities with *Carex muliensis*, *Equisetum fluviatile*, *Caltha polustris* and *Kabresia setchuenensis* were measured.
- Soil samples (0 ~ 30 cm) in natural and restored wetlands were collected.
- Total organic carbon (TOC), total nitrogen (TN) and total phosphorus (TP) in soil were estimated.
- SPSS was used for statistical analysis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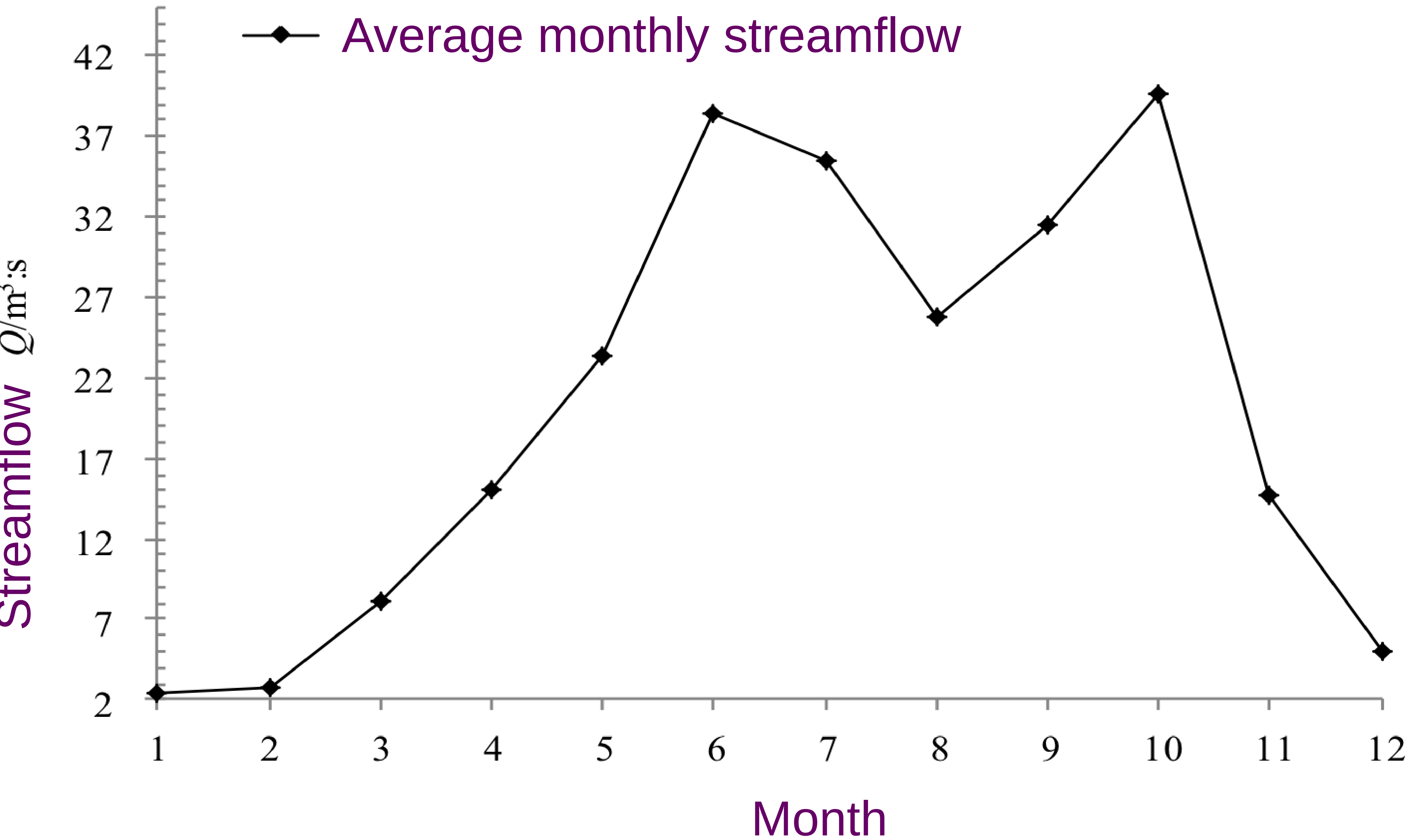
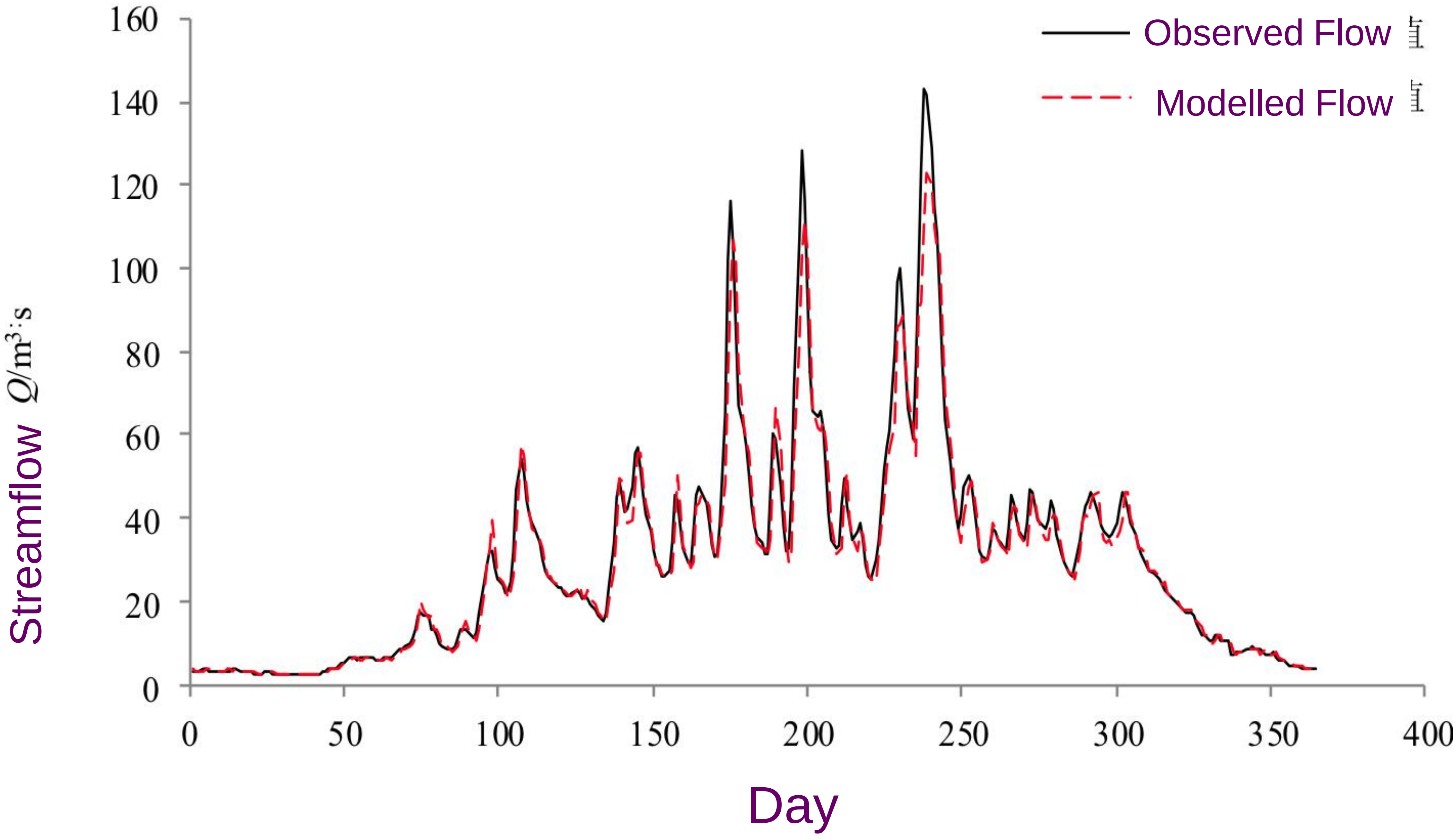
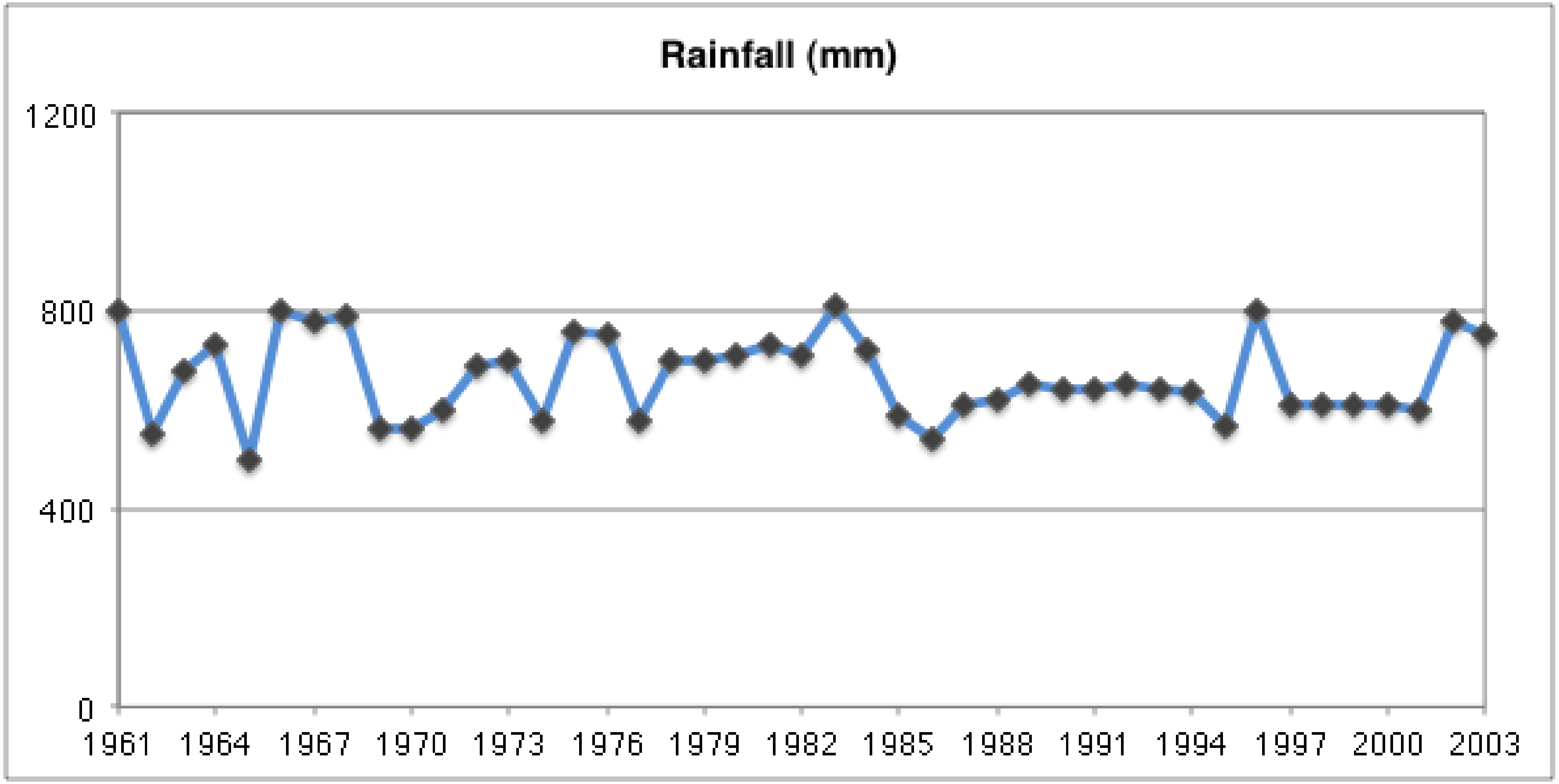
PRELIMINARY RESULTS



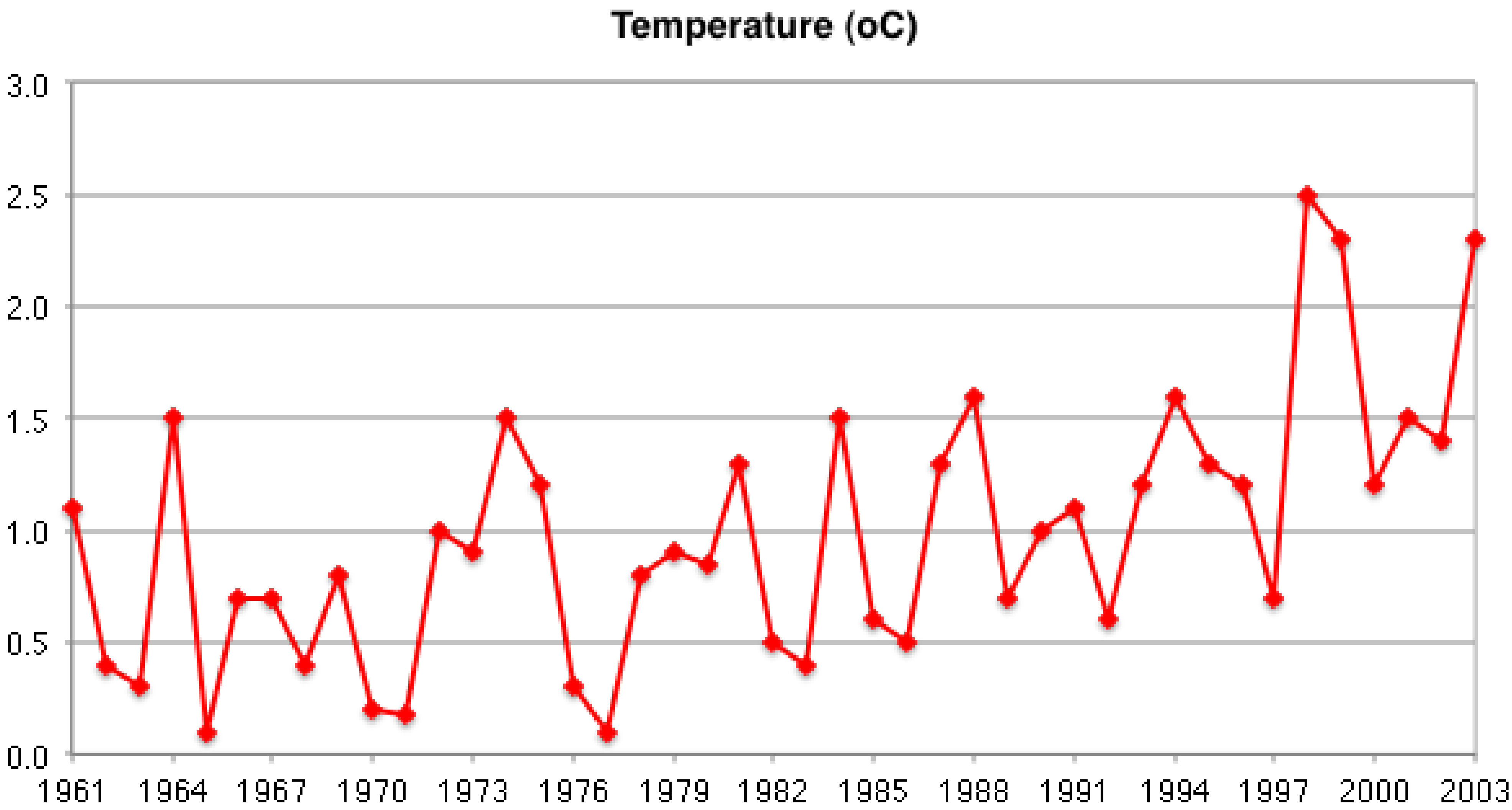
Average monthly streamflow
Streamflow $Q/m^3 \cdot s$
42
37
32
27
22
17
12
7
2
1
2
3
4
5
6
7
8
9
10
11
12
Month



Observed Flow
Modelled Flow
Streamflow Q/m³·s
Day
0
20
40
60
80
100
120
140
160
0
50
100
150
200
250
300
350
400

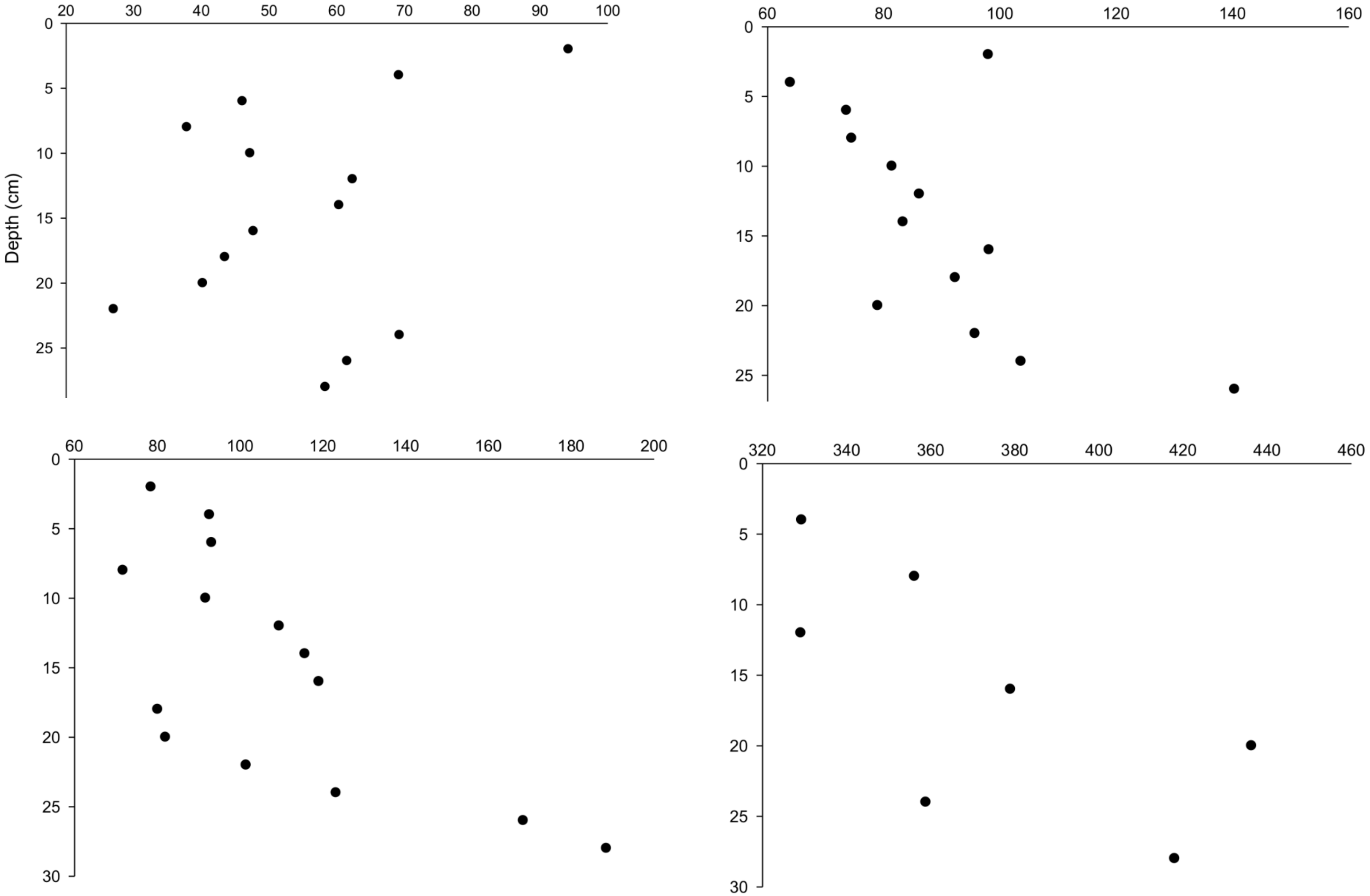


Rainfall (mm)
1200
800
400
0
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003

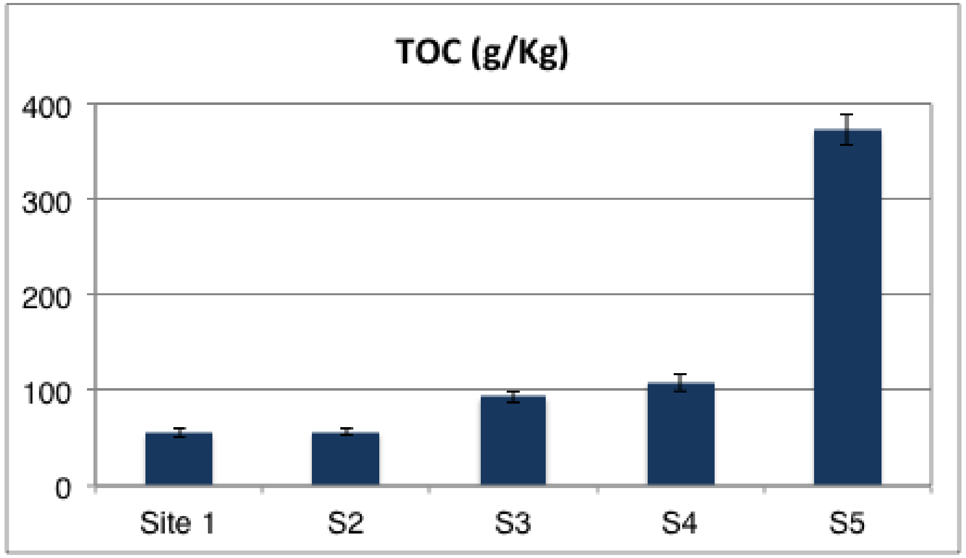

Temperature (oC)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003

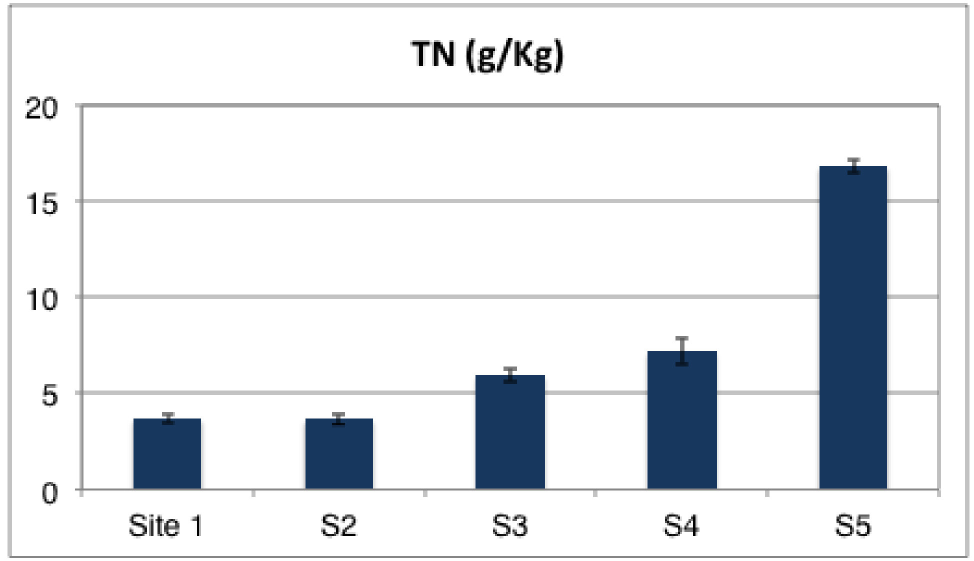
Wetland Plant Community	Biomass (g/m2)		Water level (cm)
	Above –ground	Below-ground	
Carex muliensis	653.36±120 8125.62±3920	9028.33±963	54
Equisetum fluviatile	627.44±120 8097.96±2631	10265.80±5891	50
Caltha polustris	413.48±84	-	28
Kabresia	678.99±81	-	22

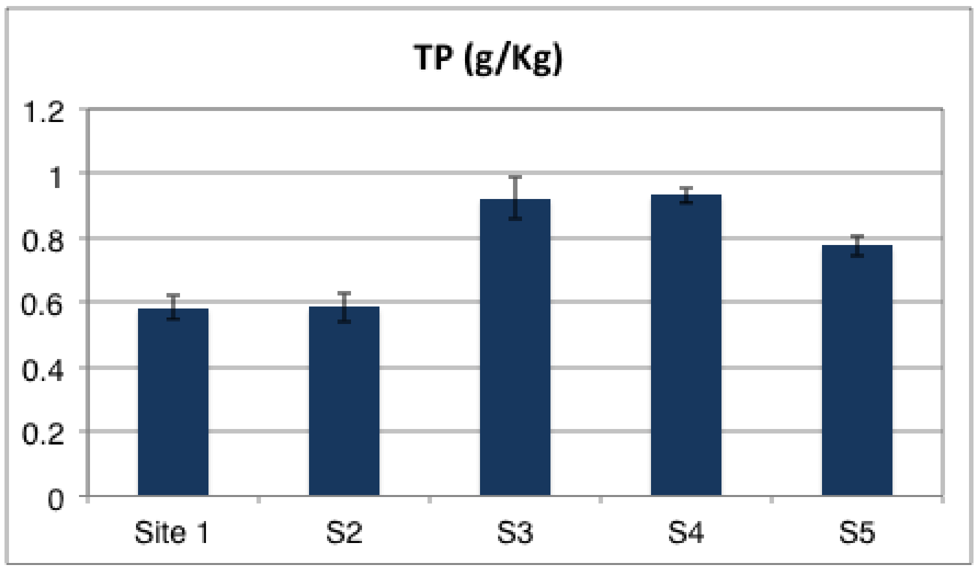
TOC (g/Kg)

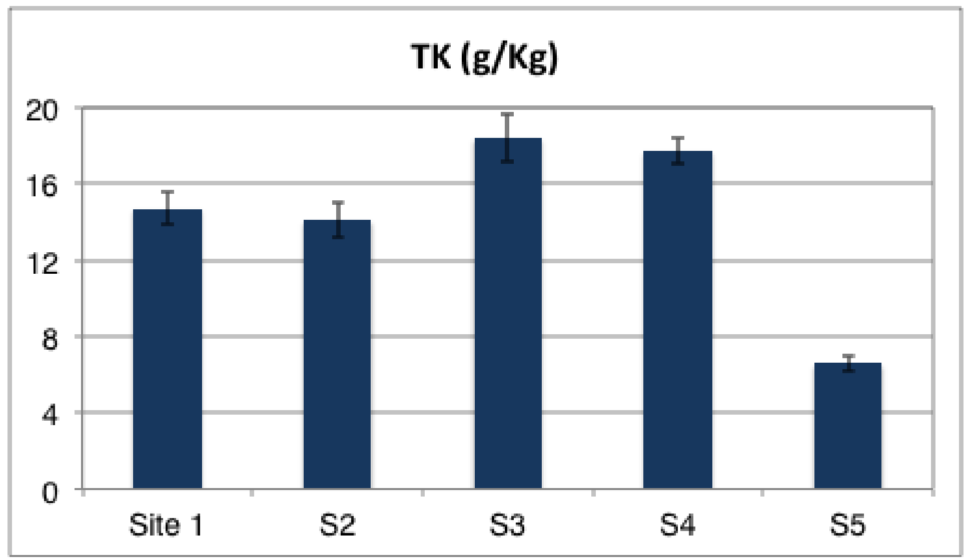


TOC, TN, TP and TK in restored and natural wetlands









CONCLUSION

- significant decreasing trend since 1988 with annual runoffs of 20.0 $m^3 s^{-1}$ (1988-1994), 19.0 $m^3 s^{-1}$ (1995-2000), and 15.2 $m^3 s^{-1}$ (2001-2008).
- no significant difference in water level between natural and restored wetlands (20-55 cm)
- significant differences in TOC, TN and TP at soil depths (0-8 cm, 8-16 cm, 16-24 cm) between natural and restored wetlands.
- much higher TOC concentration in natural wetland ranging from 35% to 40%, while higher TP concentration for restored wetlands ranged from 1007 mg/kg to 720 mg/kg.

CONCLUSION

- ratio of TOC/TN (20.67±0.3) in natural wetland was higher than ratio of TOC/TN (14.65±0.5) in restored wetlands
- significant difference ($p<0.05$) between the two community sites in TOC, TN and TP
- increased trend for TOC concentration was found in soils (0-30 cm depth) from the *Equisetum fluviatile* plant community site ranging from 78 g/kg to 188 g/kg
- higher TOC,TN and TP concentrations were found in soils (0-30cm) from the *Equisetum fluviatile* plant community site (100.75±5.49 g/kg, 6.55±0.39 g/kg and 0.93±0.03 g/kg), than in soils from the *Carex muliensis* community site (55.36±2.69 g/kg, 3.66±0.17 g/kg and 0.58±0.03 g/kg)

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