Investigating Impacts of Seedling Removal on Soil and Ground-level Vegetation Respiration (CO2 and CH4) in a Restored Peatland Ecosystem

Hehan (Zoe) Zhang

Table of contents

## 1 Results

### 1.1 Environmental Variables

During the sampling period, air temperature (Ta) at CA-DBB varied from a minimum of -11.044°C in the non-growing season to a maximum of 23.414°C in the growing season. Comparative analysis with the 5-year average annual climate data from the same location revealed that the mean temperature during the sampling year was 0.34°C higher than the 5-year annual average of 10.457°C.

Total cumulative precipitation ranged from 201.5 mm in the growing season to 817.7 mm in the non-growing season (Fig. 3.1(b)). The non-growing season recorded higher precipitation levels, with January experiencing the peak monthly precipitation of 215.2 mm. Over the sampling year, the site received 1019.2 mm of precipitation, which represents an 8% decrease from the 5-year average of 1107.14 mm.

|  |
| --- |
| Figure 3.1 (a) Daily air temperature and b) daily precipitation (blue line) and monthly precipitation (dark blue bars). |

#### 1.1.1 Biophysical Controls

##### 1.1.1.1 Soil Temperature at 5/10/30cm

Seasonal variations in soil temperature are aligned with variations in air temperature, displaying increased values during the growing season. A clear thermal gradient is evident across soil depths: soil temperatures peak at 5 cm, decrease at 10 cm, and are lowest at 30 cm, with the latter demonstrating reduced thermal fluctuation (Figure 3.2). Examination of different treatments across different ecosystem types did not reveal a uniform pattern in soil temperature variations (Figure 3.3). In the PSLS and PSTS ecosystems, sites with seedlings showed consistently higher soil temperatures across all measured depths when compared to sites where seedlings removed. Contrastingly, in the PSW ecosystem, seedlings removed sites presented higher soil temperatures at the 5 cm depth, whereas soil temperatures at 10 cm and 30 cm depths did not follow a discernible pattern.

|  |
| --- |
| Figure 3.2 Continuous soil temperature measurements corresponding to the time of each sampling event across various depths (5,10,30cm) within distinct ecosystem types (PSLS,PSTS,PSW) |

|  |
| --- |
| Figure 3.3 |

##### 1.1.1.2 Soil Water Content and Water Level

1) SWC

Soil Water Content (SWC) at Burns Bog showed clear seasonality, with lower SWC in growing season (0.158±0.117 for SWC5 and 0.337±0.149 for SWC10 ; mean ± SD across all samplings) and higher SWC in the non-growing season (0.401±0.158 for SWC5 and 0.655±0.236 for SWC10). SWC was also found to be higher at deeper soil depths.

* compare with depths: Higher SWC measured at 10cm depths, SWC increased with depth; growing season vs. non-growing season
* compare with ecosystem types: values & ranges
* compare with trts:

| GS/SWC | SWC 5 | SWC 10 |
| --- | --- | --- |
| GS | 0.158±0.117 | 0.337±0.149 |
| NGS | 0.401±0.158 | 0.655±0.236 |

July. This pattern followed precipitation, which is the primary input of water in the bog,

|  |
| --- |
| Figure 3.4 |

|  |
| --- |
| Figure 3.5 |

Table 3.1 Annual, growing season and non-growing season means of environmental variables (i.e., ) across sampling trips at each pair of treatments (S as seedlings site and R as seedling removal site) within three ecosystem types  (PSTS, PSLS and PSW)

