

# Comparison of Methane and Carbon Dioxide Emissions Across a Permafrost Thaw Chronosequence in Arctic Sweden



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## INTRODUCTION

- Permafrost peatlands are ideal environments for the accumulation of organic carbon
- Carbon sinks contribute to a cooling effect on Earth's overall climate
- Degradation of these sinks due to higher air and ground temperatures is accelerating the rate of carbon emissions



Figure 1. Study region in discontinuous permafrost zone in Stordalen Mire, Sweden (Matthew Green, 2019)

## SITE DESCRIPTIONS

- Carbon (C) emissions were measured at two palsa sites: AvCj-P & AvCj-P (ERVA) and three fen sites: AvC-P (recently collapsed), AvCe-C & AvCe-F (past collapsed)

Palsas are commonly found in discontinuous permafrost zones of the Arctic. They are small hills covered in peat and have a frozen core. Prolonged increasing annual temperatures and precipitation result in the thawing of the permafrost which in some cases gives rise to ecosystems that are more methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) productive such as bogs and fens.

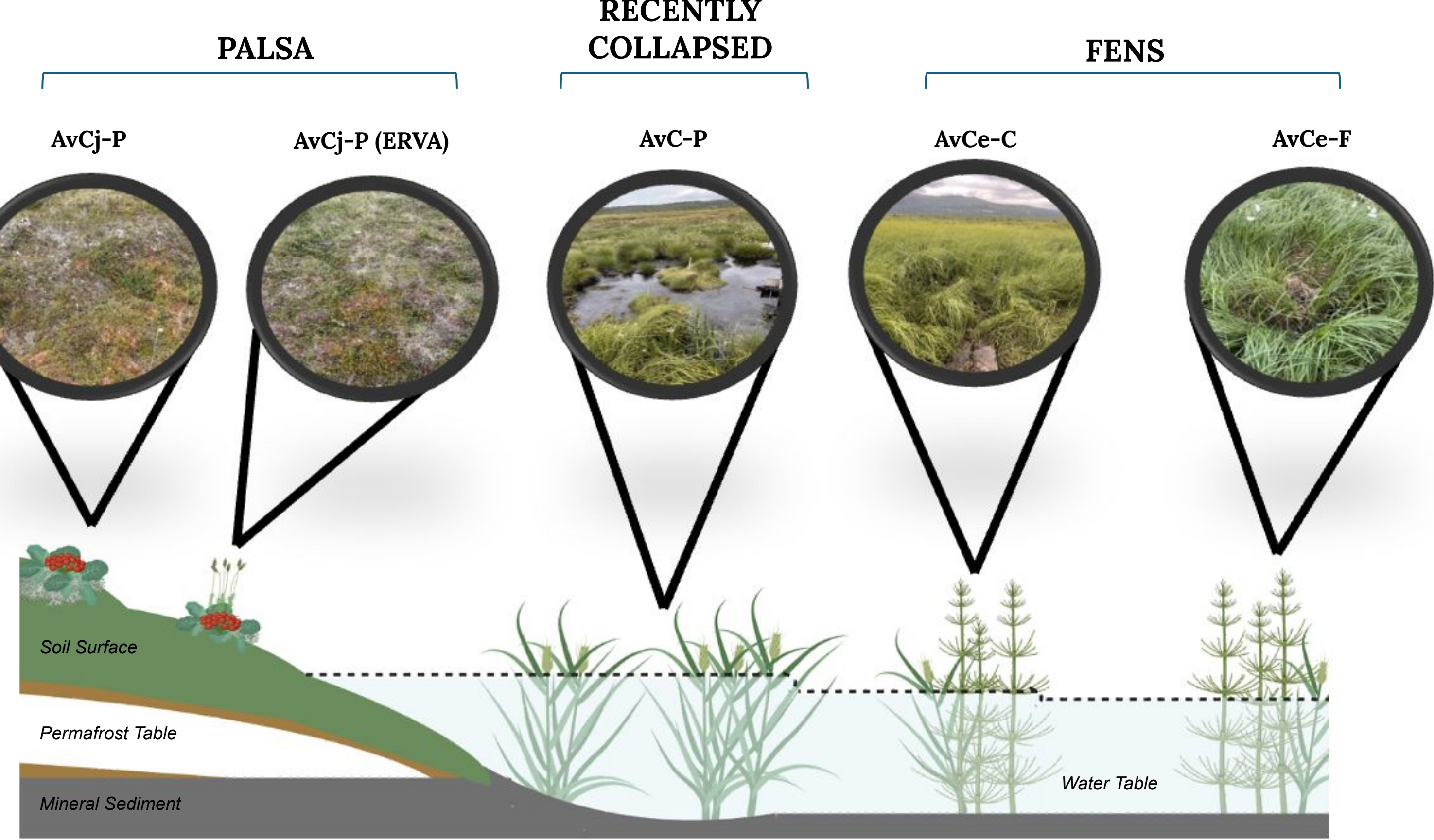


Figure 1.5. Transition from palsa to fen ecosystems in relation to sites sampled. Diagram by Alanna A. Nenadich Álvarez

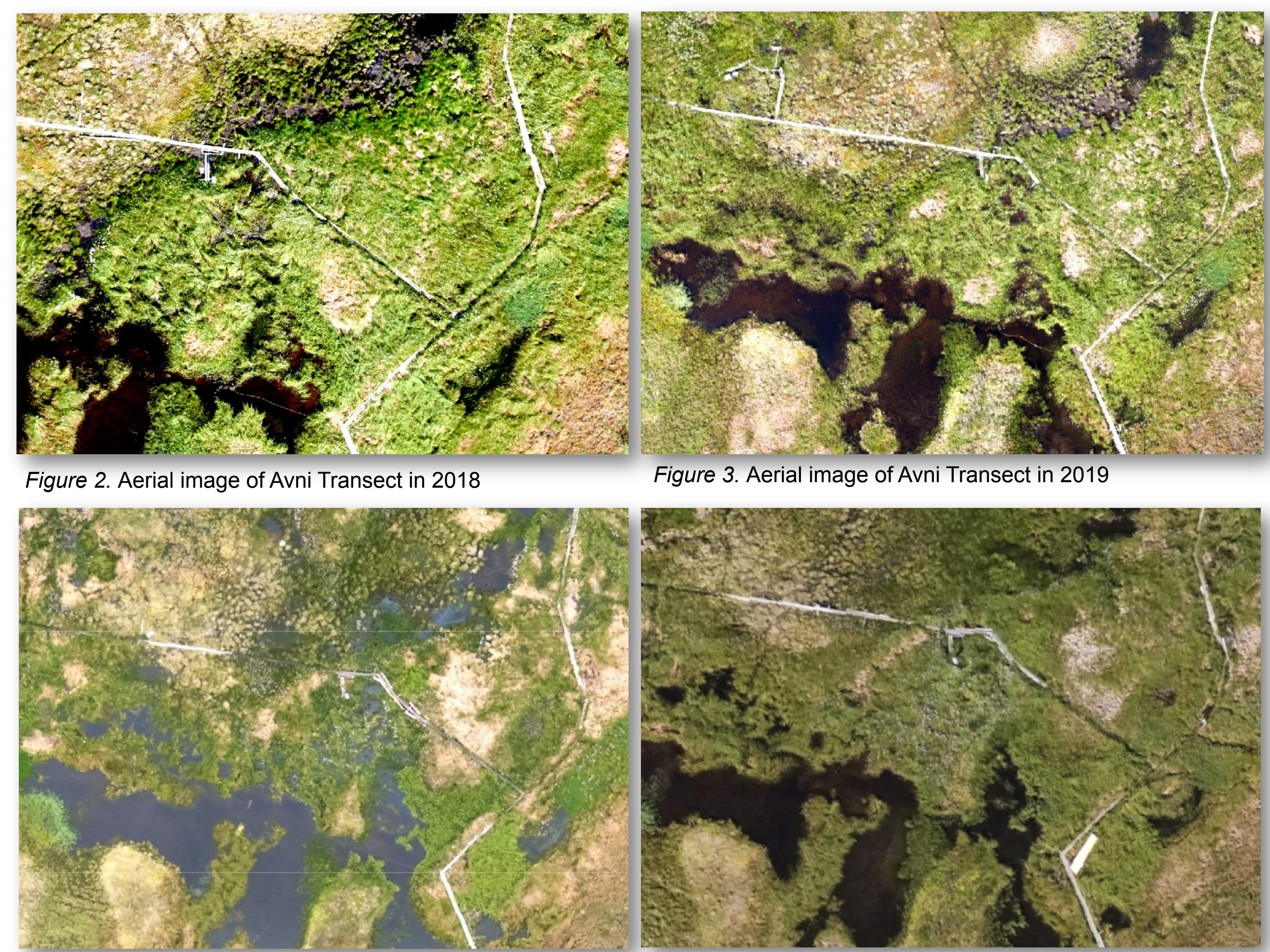


Figure 2. Aerial image of Avni Transect in 2018. Figure 3. Aerial image of Avni Transect in 2019. Figure 4. Aerial image of Avni Transect in 2023. Figure 5. Aerial image Avni Transect in 2024

Source: UNH SAD Remote Sensing

## MATERIALS / METHODS

- We measured CH<sub>4</sub> and CO<sub>2</sub> emissions using a static chamber method and portable gas analyzer
- Other measurements taken at each sub-site: active layer depth, soil temperature, soil moisture, air temperature, pH and water temperature, photosynthetically active radiation (PAR), and vegetation type

## RESULTS & CONCLUSION

CH<sub>4</sub> and CO<sub>2</sub> emissions follow a trend after palsa collapse. Recently collapsed sites release more methane and as time passes, these emissions decrease. This indicates that these transition sites are hot spots for microbial decomposition of recently thawed peat and also that their location shifts as thaw progresses making them transient but important locations in these climate sensitive landscapes.

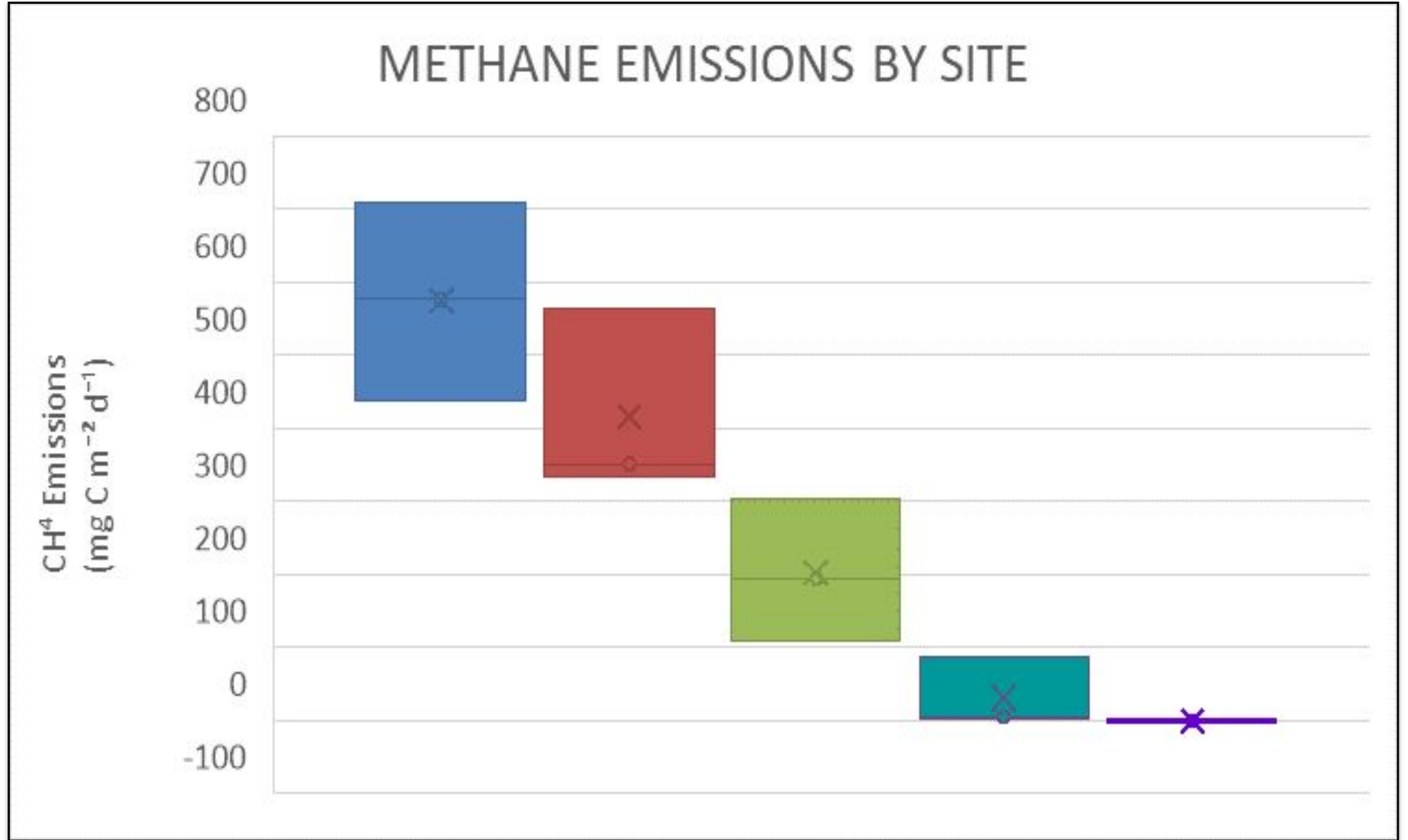


Figure 6. CH<sub>4</sub> emissions by site

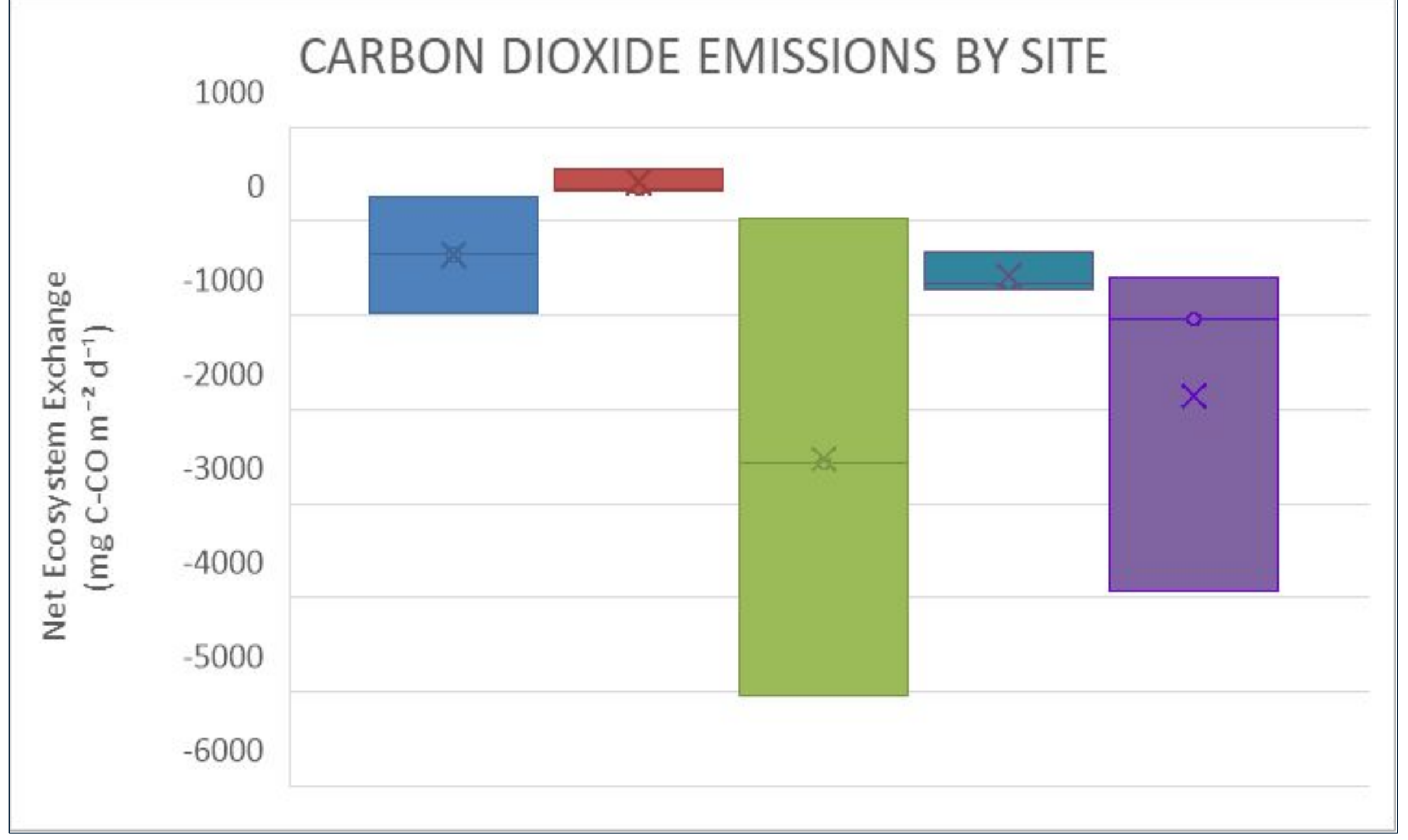
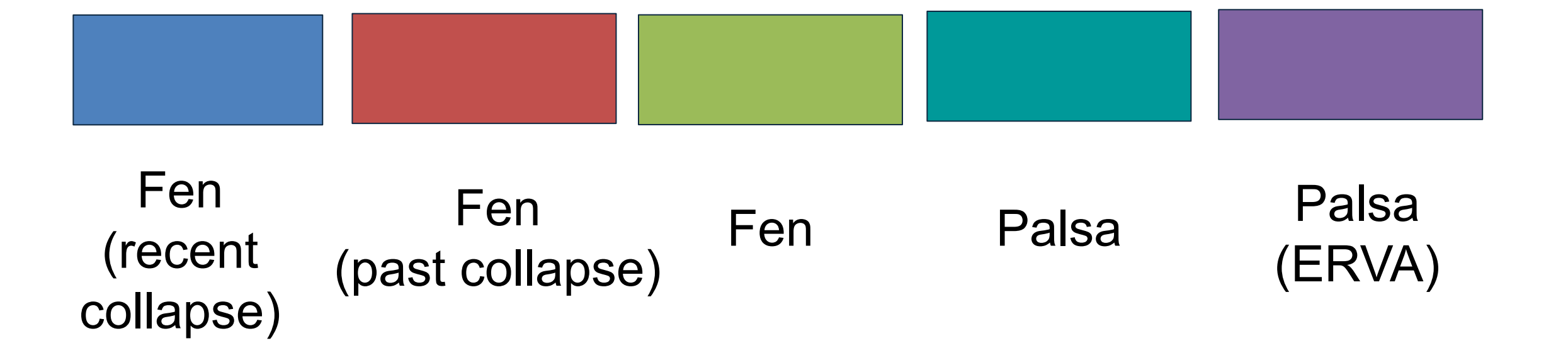


Figure 7. CO<sub>2</sub> emissions by site



## REFERENCES

Matthew Green, R. (2019), Meet three women who are racing to defuse a climate-change bomb in the Arctic, *ArcticToday*. Available from: <https://www.arctictoday.com/meet-three-women-who-are-racing-to-defuse-a-climate-change-bomb-in-the-arctic/> (Accessed 31 July 2024)

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