

# FROM DEGRADATION TO DISTURBANCE:

## Pesticide Impacts On Cryoconite Microbial Communities From An Alpine Glacier And The Greenland Ice Sheet

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CRYOSPHERIC ECOSYSTEMS CONFERENCE  
4. SEPTEMBER 2025

LARS GERIE VAN DIJK  
PH.D.-STUDERENDE



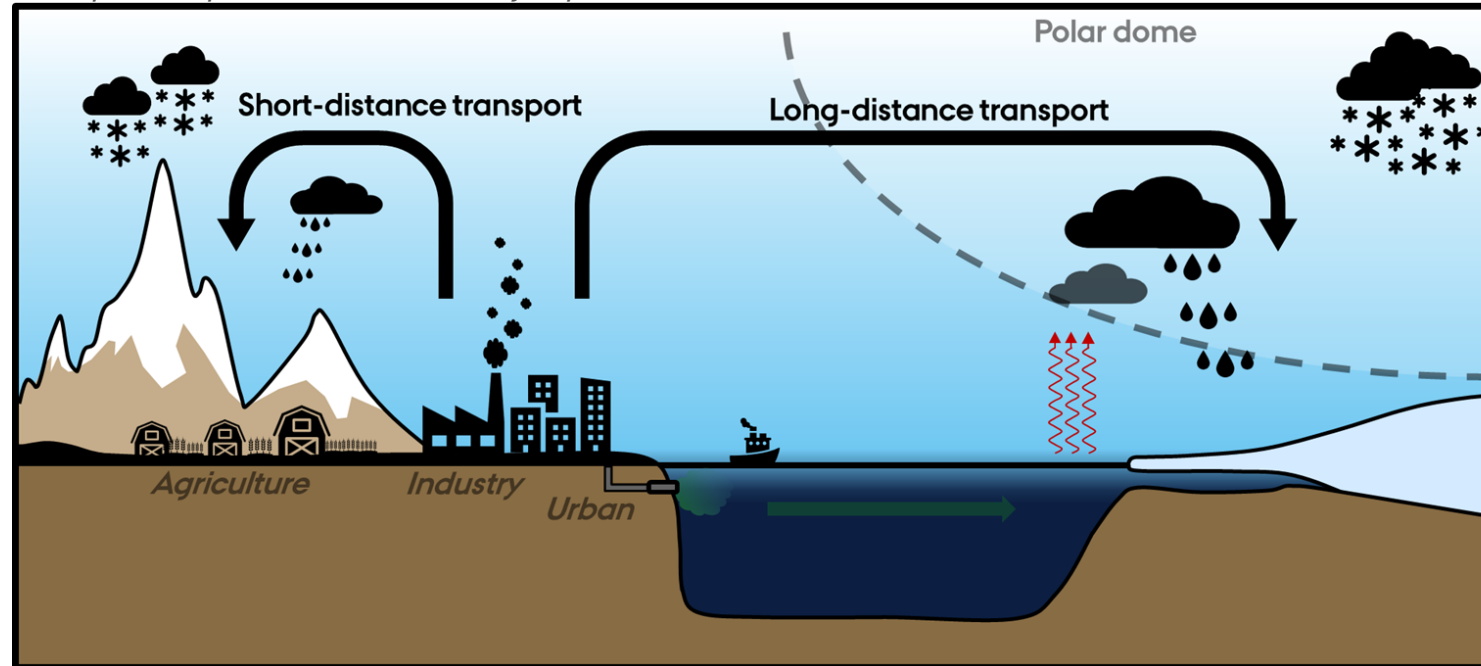
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# WHY PESTICIDES?

- They are found in glacier systems (cold-trapped)
  - Cryoconite accumulates pollutants
- Chlorpyrifos (2–3  $\mu\text{g}$  per gram cryoconite) - (Claudia Ferrario et al. 2017)

*Transport of pollutants to the cryosphere*



# KNOWLEDGE GAPS

1) **Degradation potential** of pollutants in cryospheric systems?

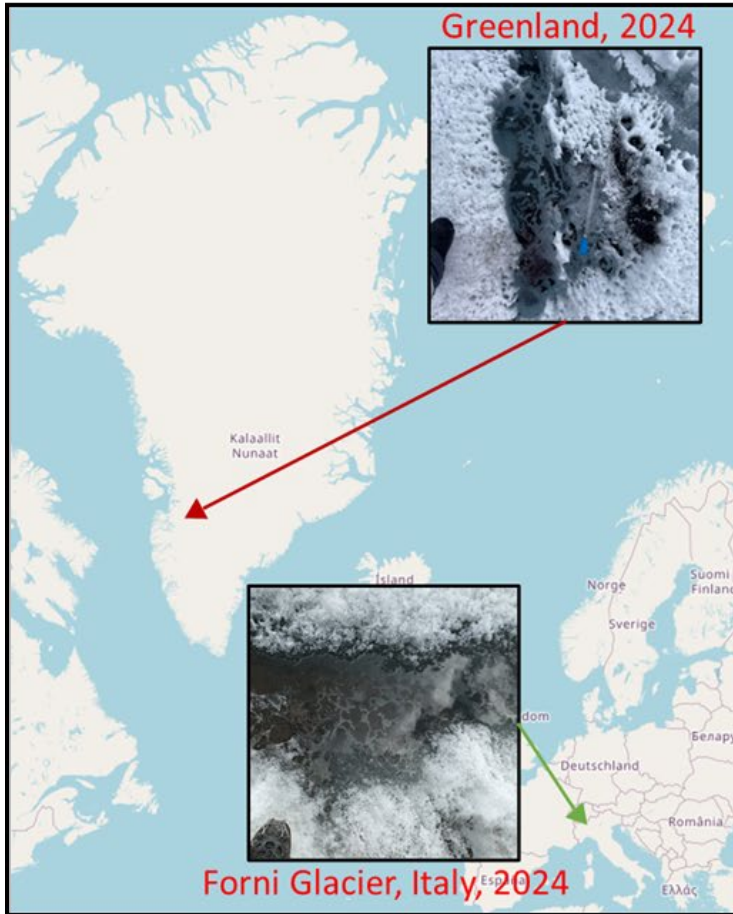
2) **Who** are the degraders, and which genes are involved?

3) What are the impacts of pesticides on the **whole microbial community** and **ecosystem functioning**?

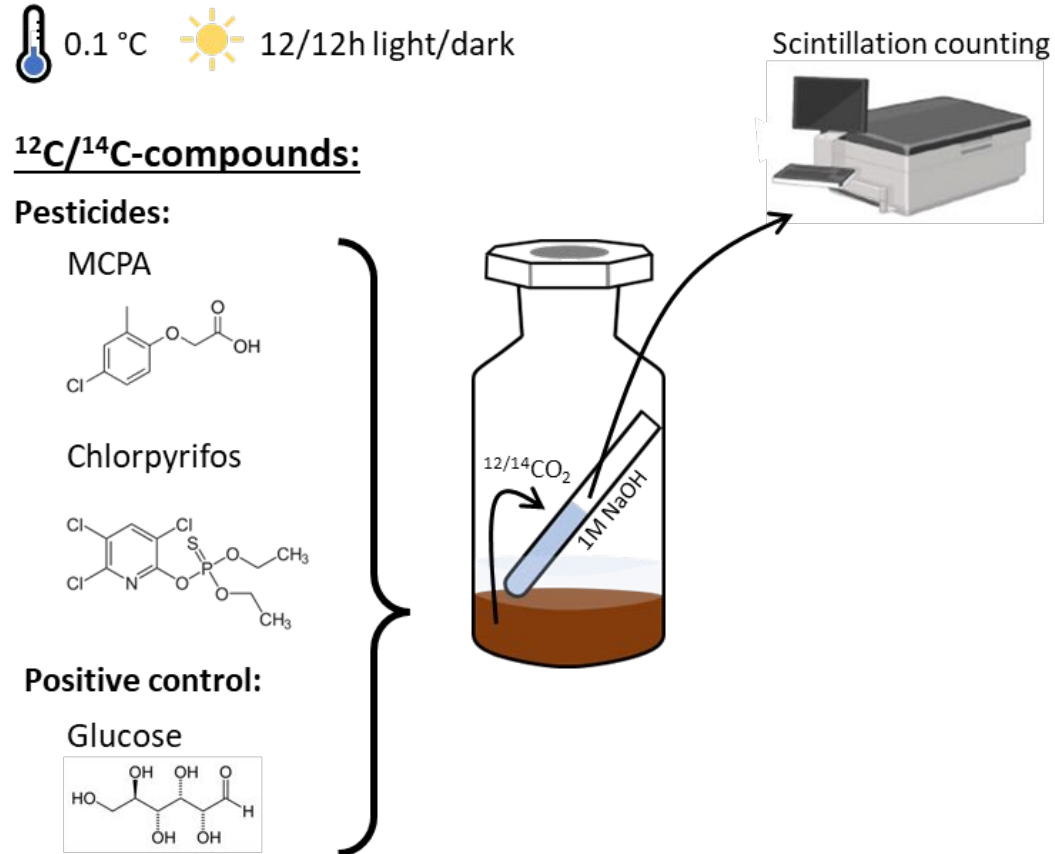


# 170-DAY MICROCOSM EXPERIMENT

## Samples and sample locations



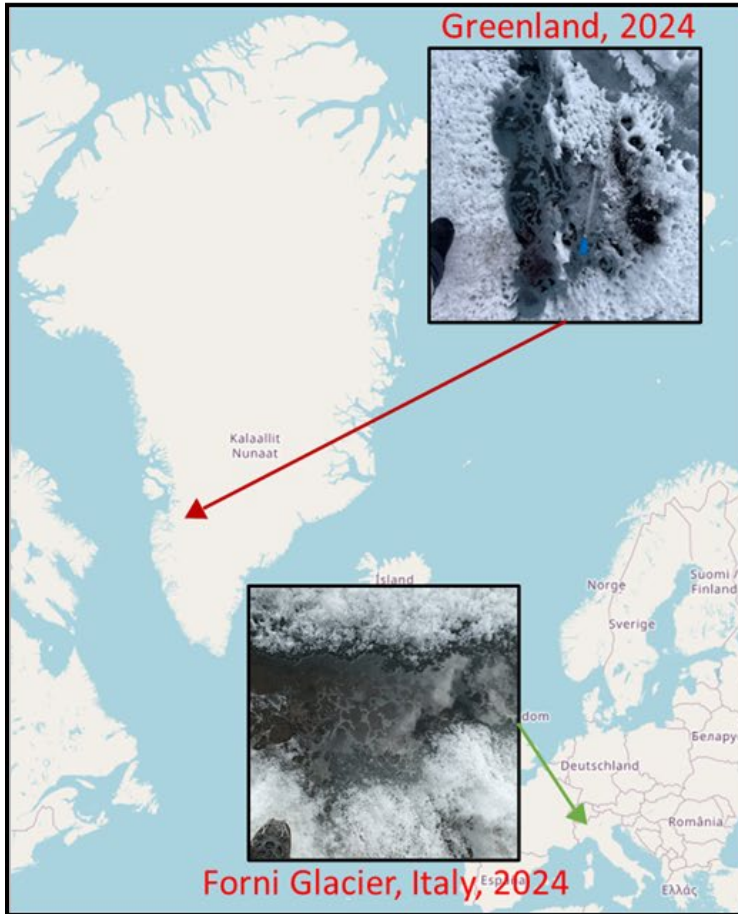
## Long-term experimental incubations





# 170-DAY MICROCOSM EXPERIMENT

## Samples and sample locations



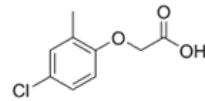
## Long-term experimental incubations

0.1 °C 12/12h light/dark

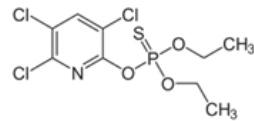
$^{12}\text{C}/^{14}\text{C}$ -compounds:

Pesticides:

MCPA

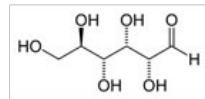


Chlorpyrifos

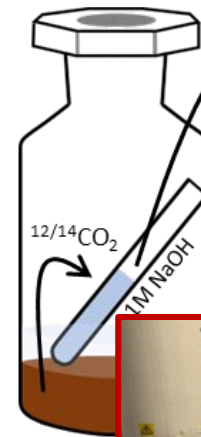


Positive control:

Glucose



Scintillation counting



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# RESULTS (PRELIM.)

Concentration (ppm)

● 100 ppm

▲ 1 ppm

◆ 100 ppm - sterile control

Percentage mineralized  $^{14}\text{C}$ -compound

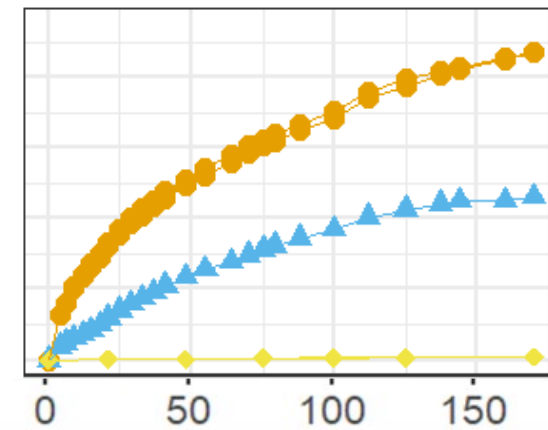
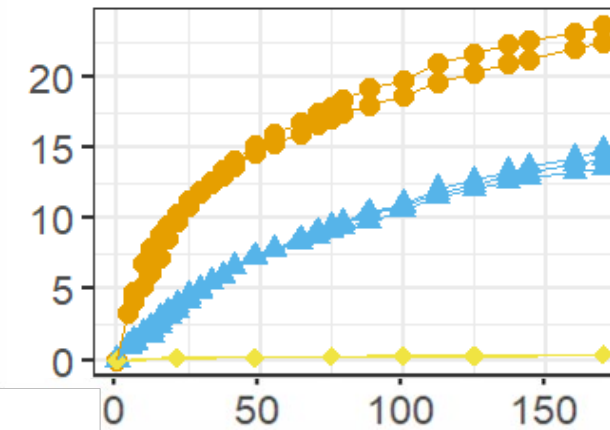
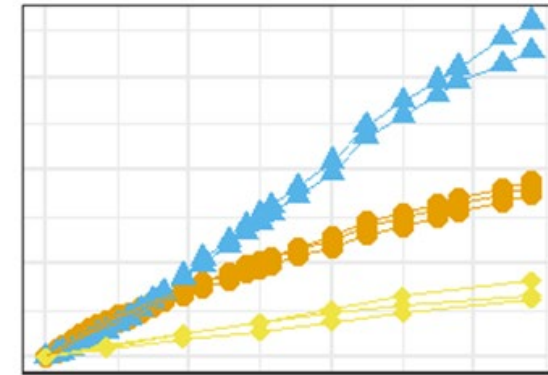
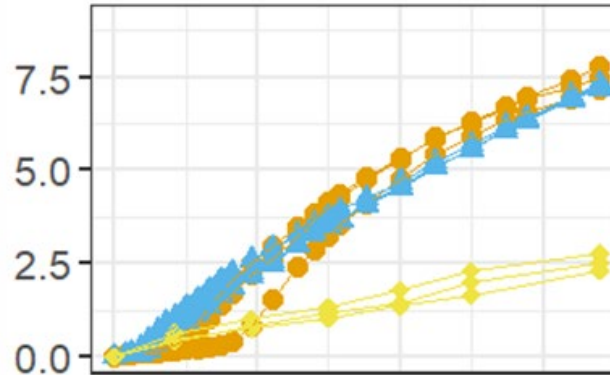
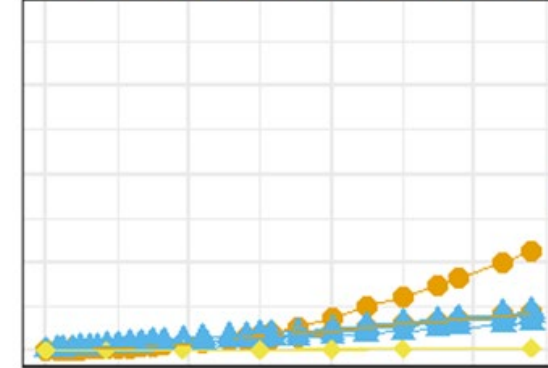
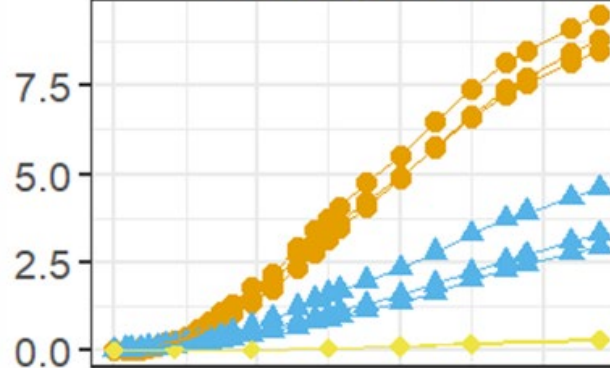
Forni glacier

Greenland ice sheet

Chlorpyrifos

MCPA

Glucose



Days



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# CONCLUSION

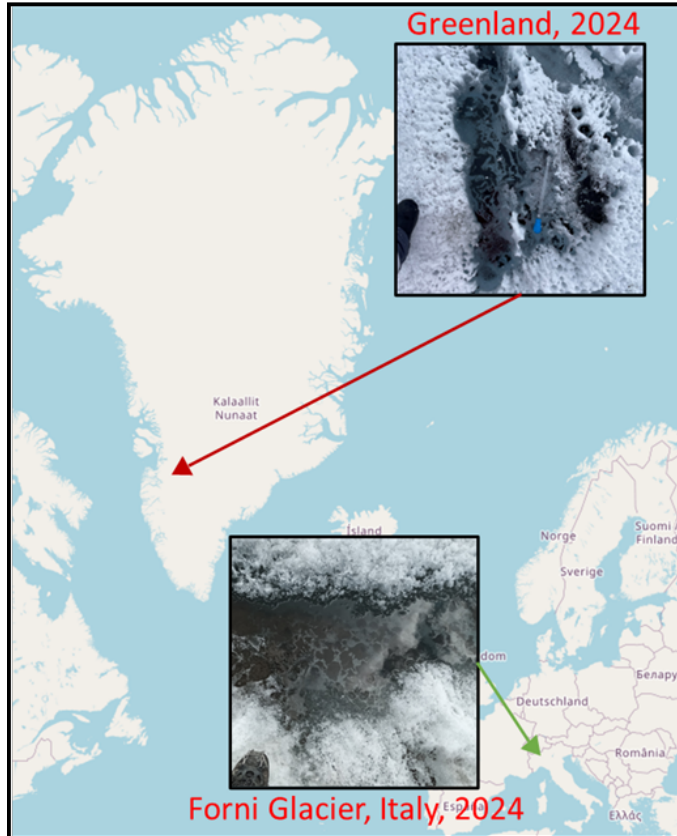
Strong site difference in pesticide degradation between the Forni glacier and the GrIS, reflecting pollution history.





# WHAT'S NEXT?

## Samples and sample locations



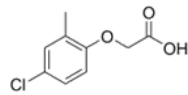
## Long-term experimental incubations

0.1 °C 12/12h light/dark

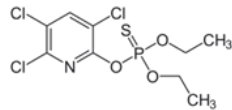
### $^{12}\text{C}/^{14}\text{C}$ -compounds:

#### Pesticides:

MCPA

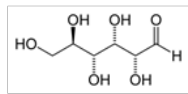


Chlorpyrifos

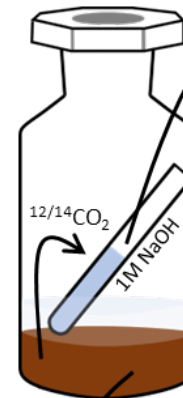


#### Positive control:

Glucose



1 ppm & 100 ppm



Scintillation counting



qPCR and HRM analysis

**Paper I**

**Modelling** of pesticide degradation rates and qPCR-based DNA/RNA abundances of targeted degradation genes



A. Cuzzeri  
universität  
innsbruck

DNA RNA

Total RNA +  
metagenomic  
sequencing

**Paper II**

Assessing **whole-community responses** to pesticides via time-series meta-omics analysis

### Paper III

Isolation and characterization of **pesticide degraders** and the identification of (novel) genes involved





# ACKNOWLEDGEMENTS

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<https://www.icebio.eu/>

LinkedIn



More updates at the...

**10<sup>th</sup> Polar and Alpine Microbiology (PAM) conference**  
in Copenhagen (Denmark)

**When:** 12-16 January 2026

**Opening of registration:** end of September 2025

See also:

<https://www.icebio.eu/pages/pam2026/index.html>



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