

Multi-facility municipal waste evaluation on GHG emissions, carbon storage, and nutrient recycling across Canada

Alexis de Laronde

MSc, BSc

IWM Lab

Dalhousie University - PhD

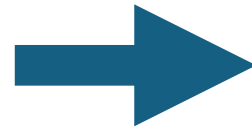


2023: IPCC determined methane and nitrous oxide concentrations **higher in 2019 than any time in past 800 000 years**



Waste Sector

- 1.3 billion tones of FW generated in the world **releasing 3.3 billion tones of CO2**
- **Landfills are 3rd largest** contributor to methane emissions



- Literature is very fragmented
- **Inconsistent** measurement approaches
- **Lack of routine data** collection
- **Non-standardized** or non-existent data frameworks

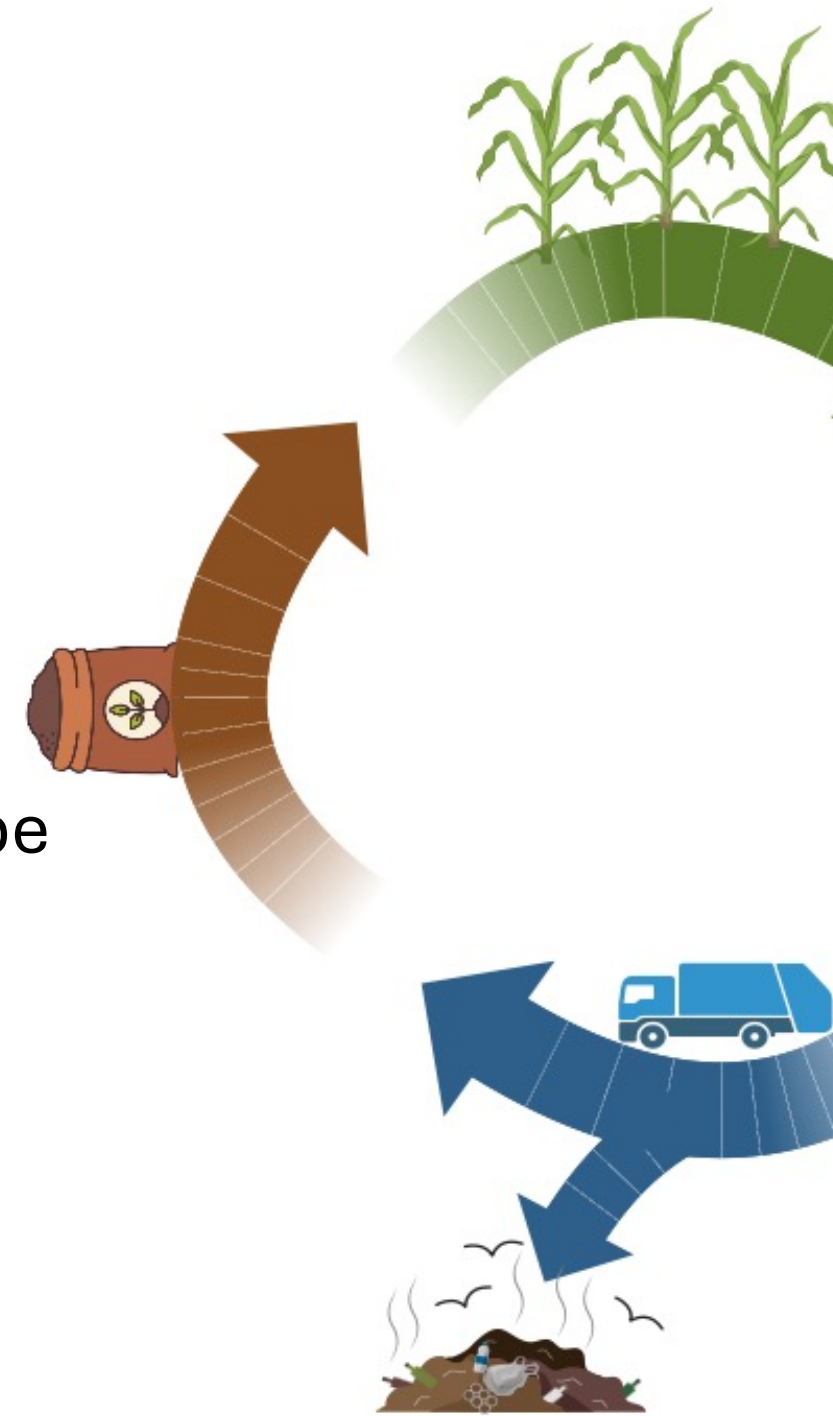


Agriculture Sector

- **43% increase** in nitrogen fertilizer application and nitrous oxide emissions
- 2021: **10% Canadas GHG** came from Ag sector



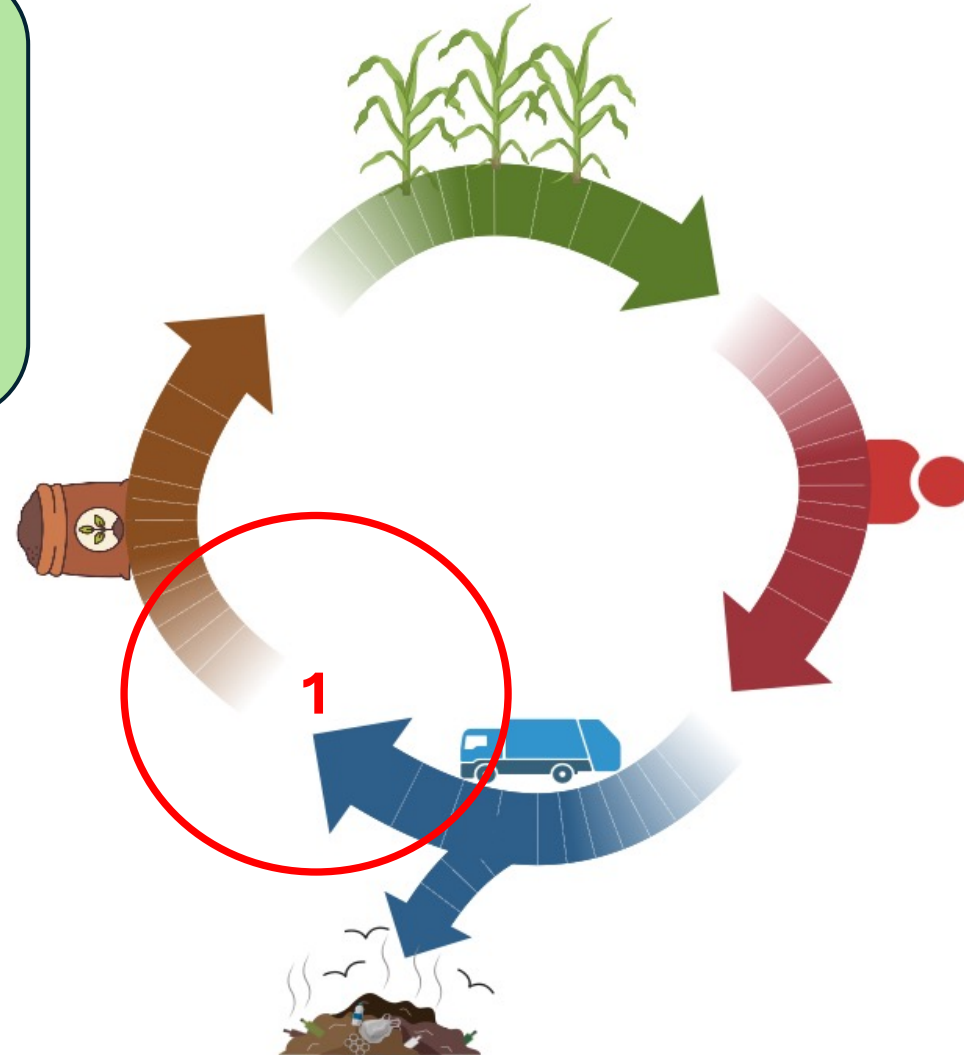
- **Discrepancies** regarding biosolid amendment type and GHG emissions
- **Limited data** linking the above to **soil health indicators**
- **Limited to no data** characterizing changes to **microbial communities** and GHG by biosolid application



Multi-facility municipal waste evaluation on GHG emissions, carbon storage, and nutrient recycling across Canada

1: Evaluating compost properties during various stages of decomposition and GHG emissions with multiple organics facilities across Canada

- **3 Facilities**, monthly measurements
- Changes to **physiochemical properties** during decomposition
- **GHG emitted**
- C used : C stored
- Overall C footprint

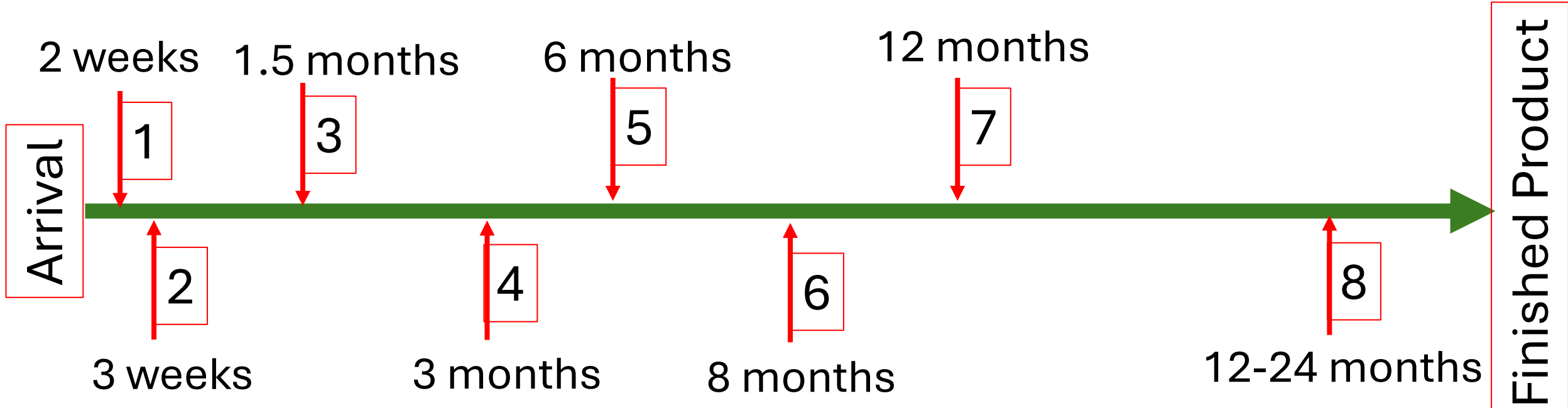


1) Organic Waste Facilities - Methods

- Moisture, bulk density, air-filled pore space, temperature
- Total carbon, total nitrogen
- Organic matter
- Nitrate, ammonia
- pH
- Respiration + GHG profile
- **Environmental footprint assessment**



Looking for more partnerships to sample and share operational data!





Early Stages

2 weeks – 3 months

3 – 8 months



1 year

Heat coming off!



1 year

Heat coming off!



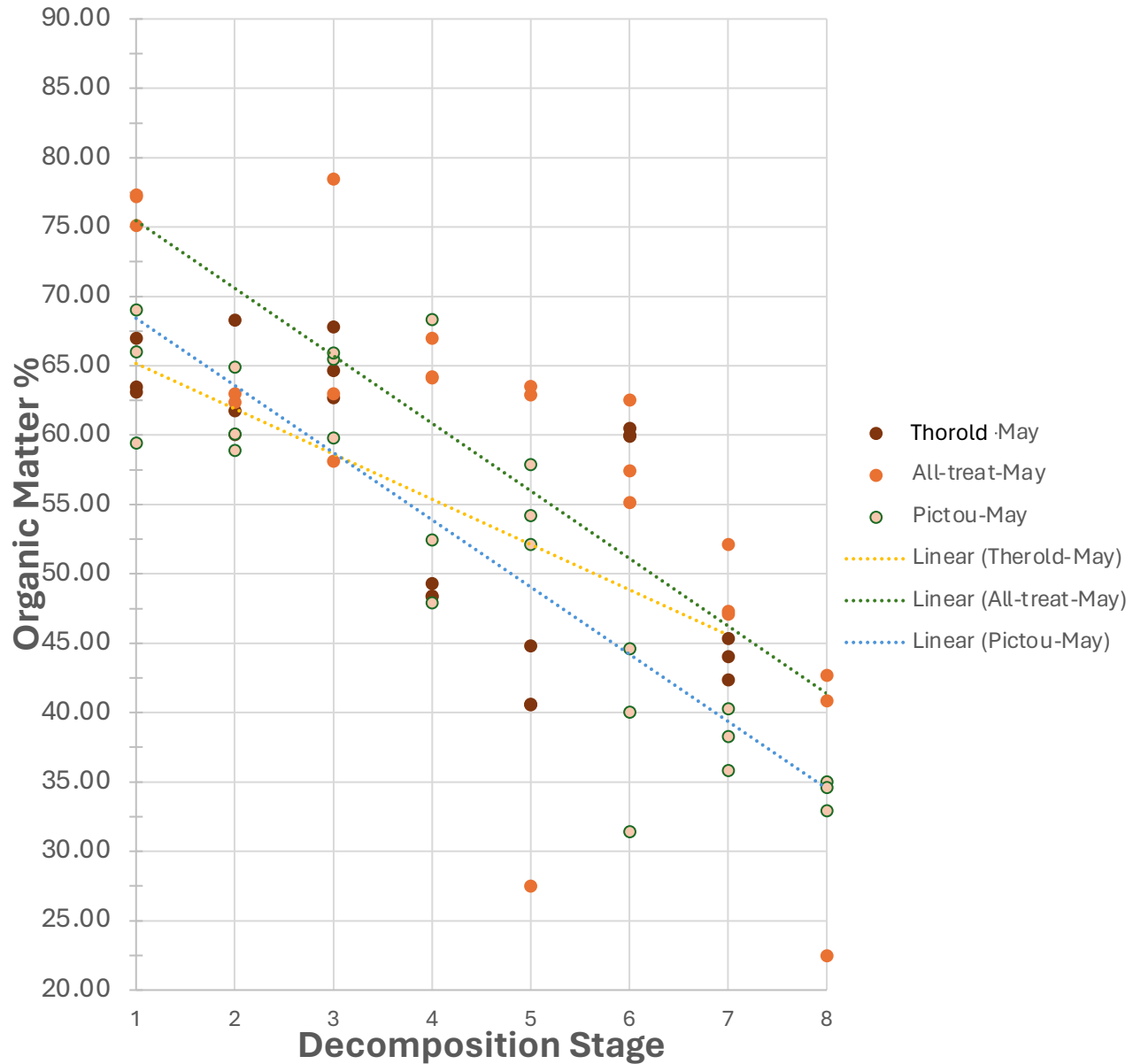


Finished Product

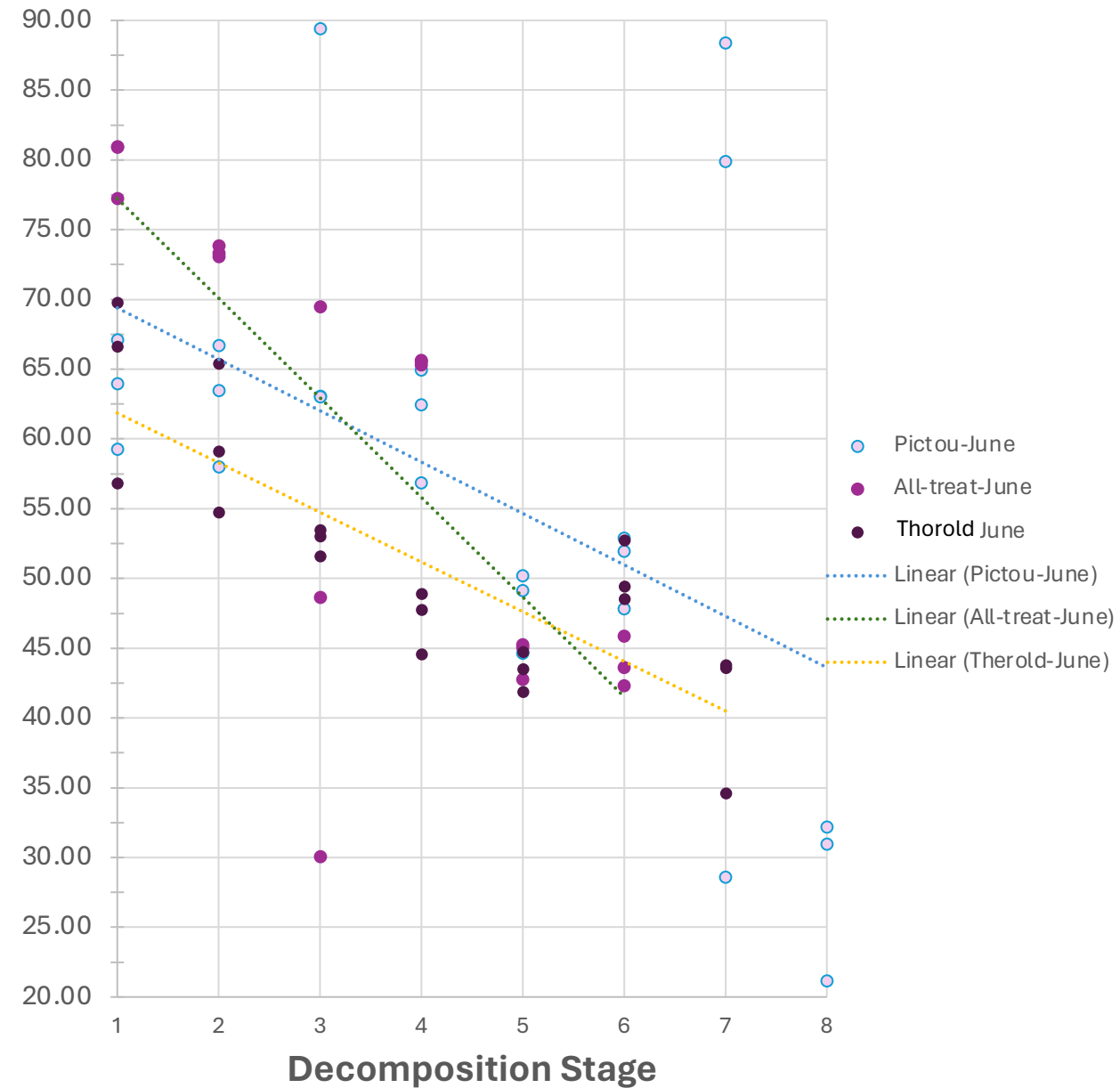
1 - 2 years

Organic Matter

May



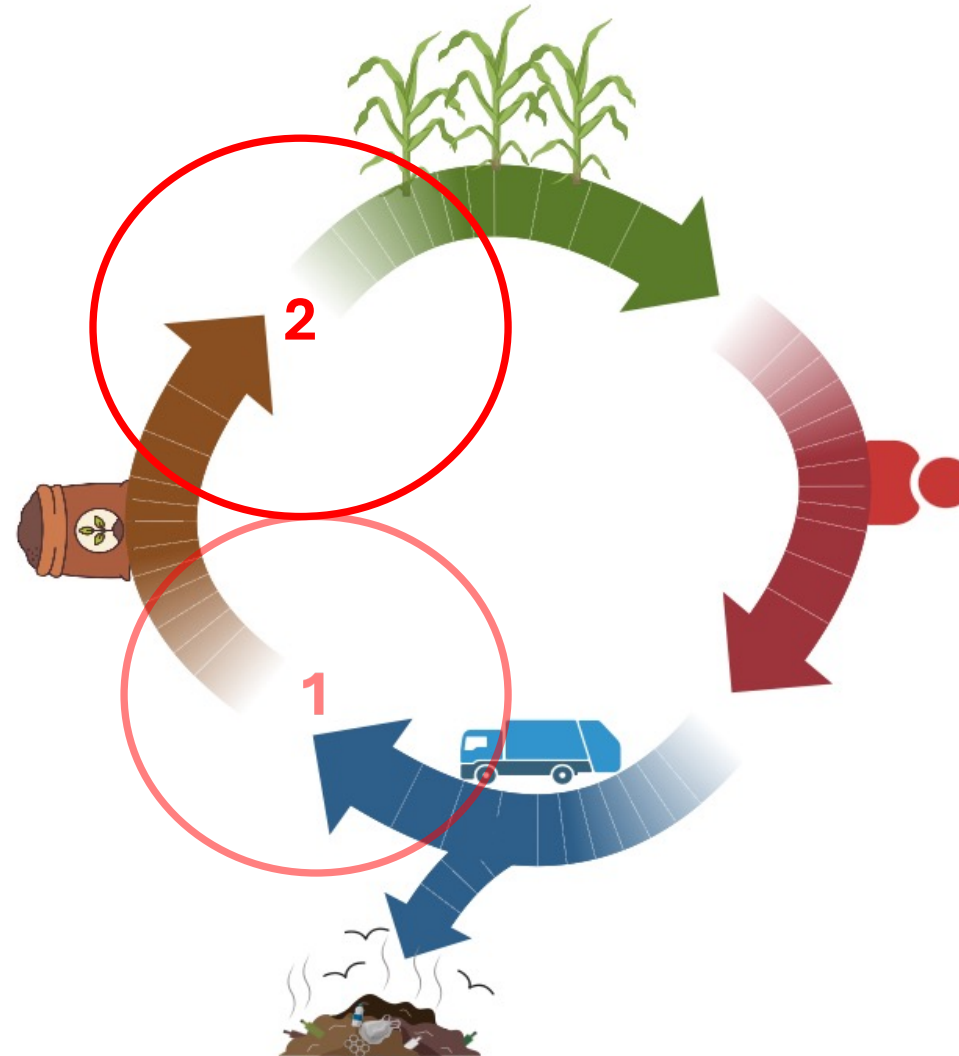
June



Multi-facility municipal waste evaluation on GHG emissions, carbon storage, and nutrient recycling across Canada

1: Evaluating compost properties during various stages of decomposition and GHG emissions with multiple organics facilities across Canada

- **3 Facilities**, monthly measurements
- Changes to **physiochemical properties** during decomposition
- **GHG emitted**
- C used : C stored
- Overall C footprint

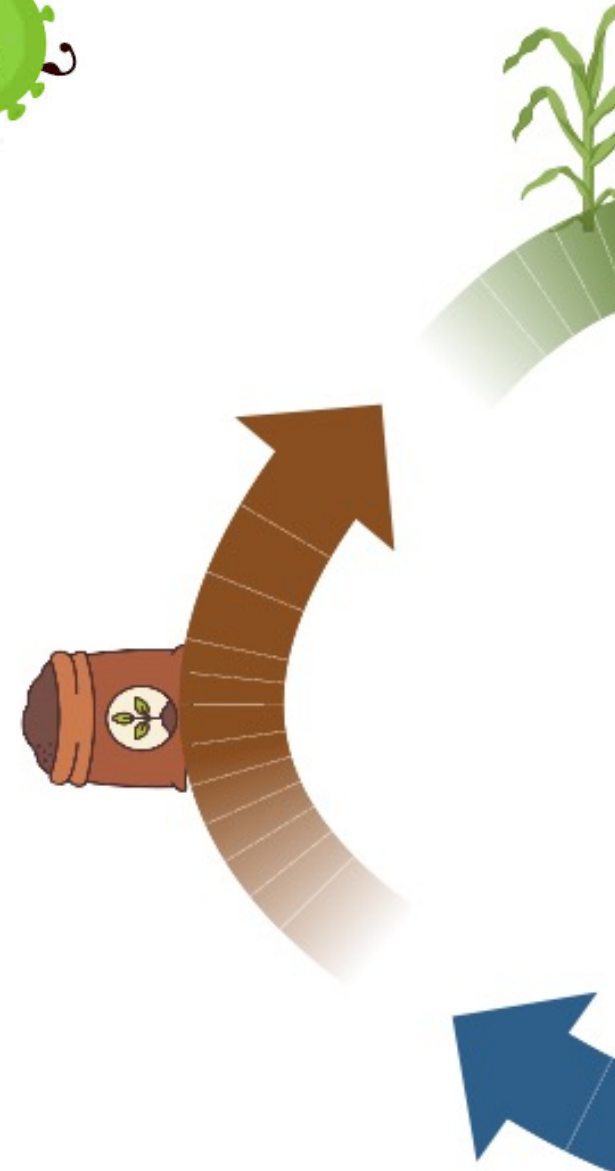


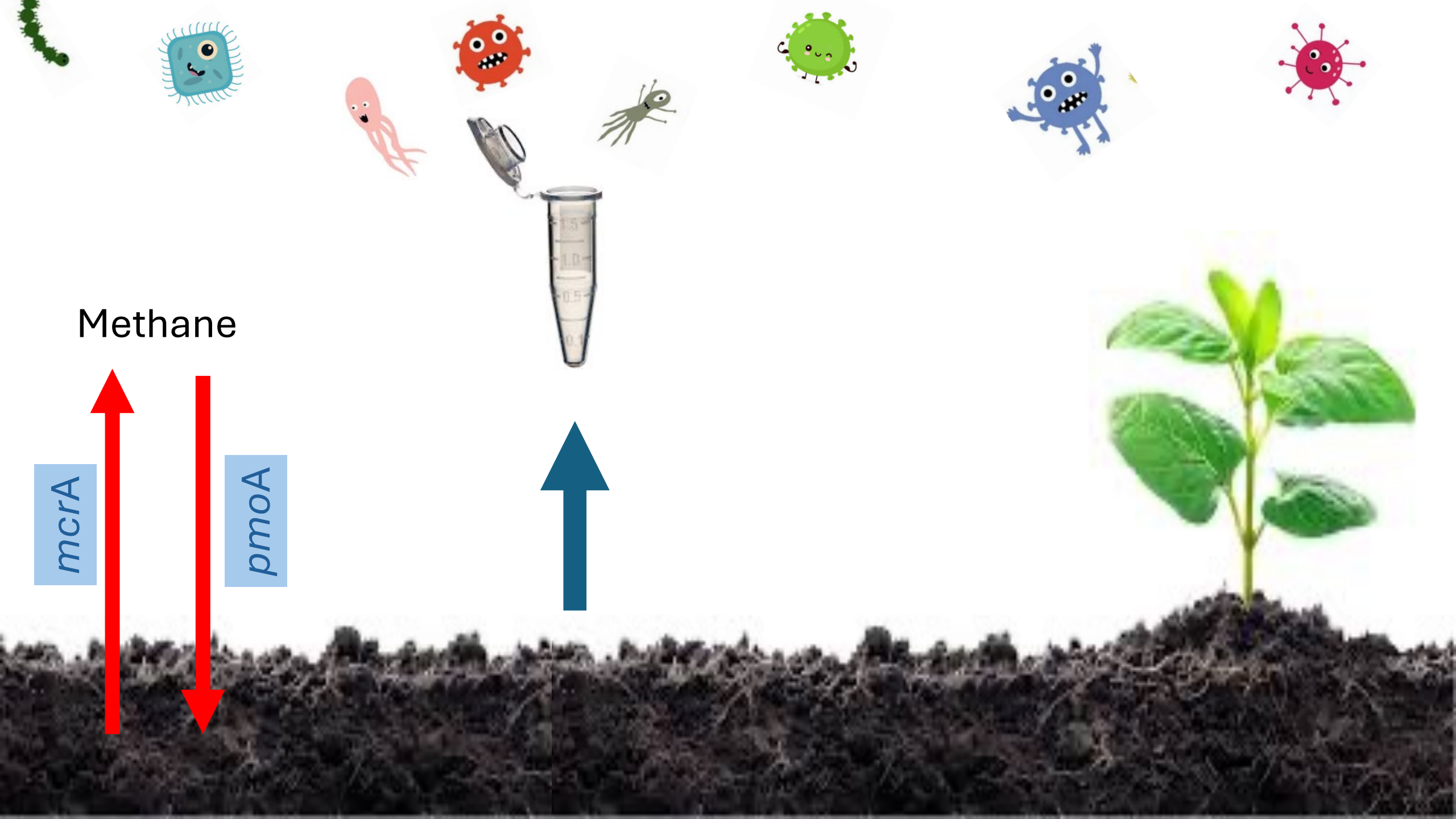
2: Benefits that the finished product has to soil

- Bi-monthly **GHG measurements**
- Changes to **soil health** (abiotic)
- Changes to **microbial genes** associated with biogeochemical cycles (biotic: DNA sequencing)

2) Return to Soil - Methods

- Bulk density, moisture, temperature, air-filled pore space, pH
- Soil health indicators:
 - Organic carbon
 - Inorganic carbon
 - Soil organic matter
 - Total nitrogen
- Nitrate, ammonia
- Bi-monthly gas sampling at 15-, 30- 45- 60- minute period
- **DNA sequencing**



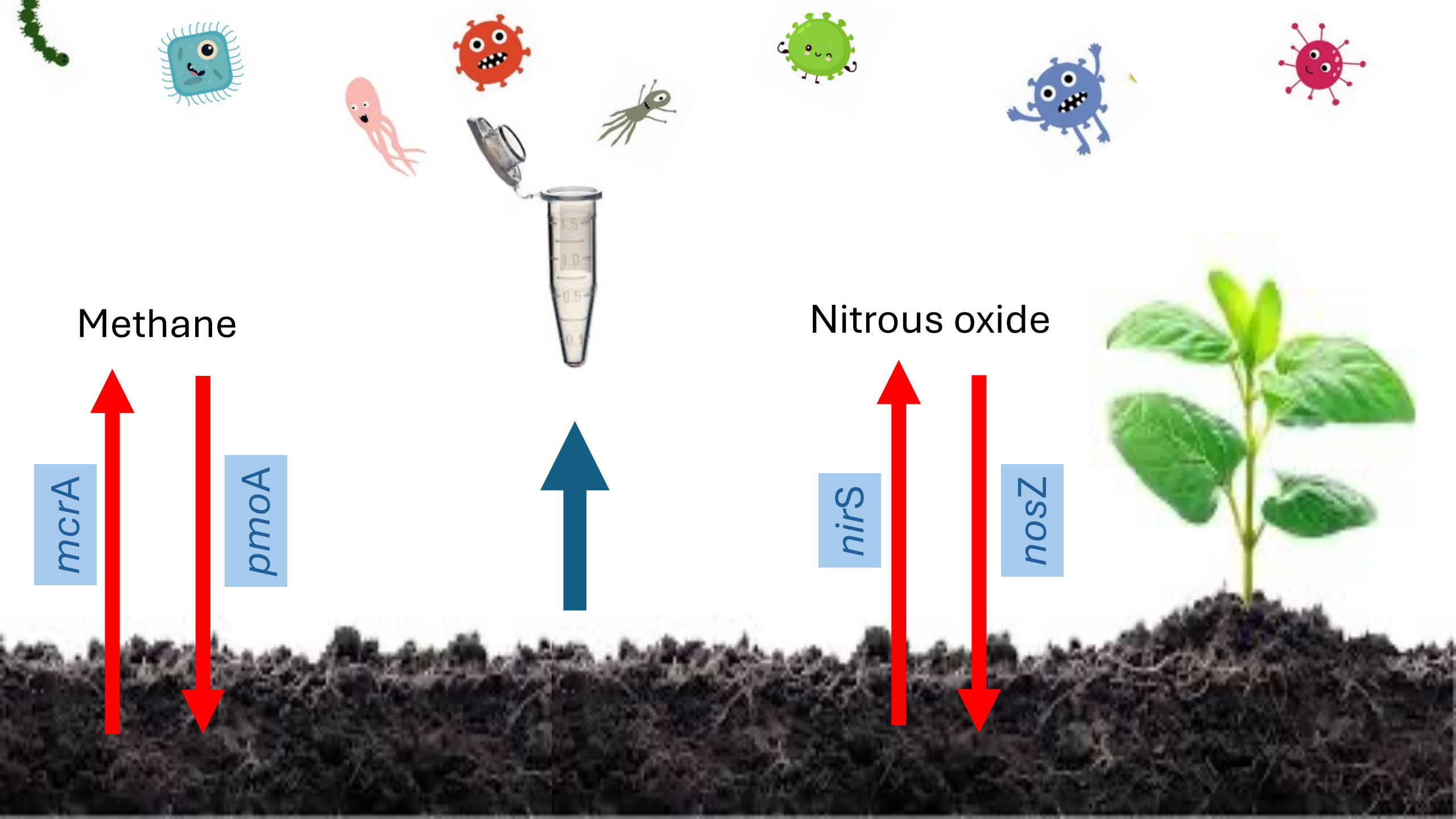


Methane

mcrA

pmoA





Methane

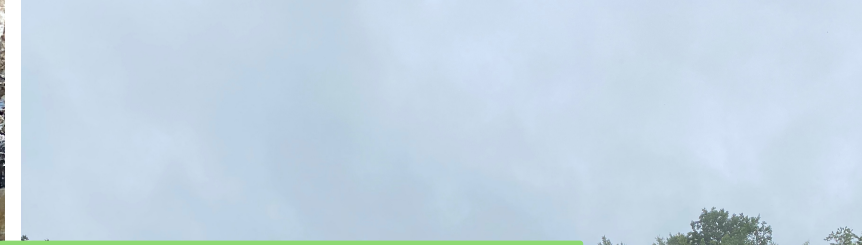
Nitrous oxide

mcrA

pmoA

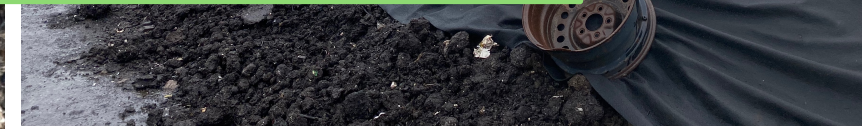
nirS

nosZ



1) Evaluating Organics Facilities:

- **Data generation** where frameworks were limited or non-existent
- Generate **GHG inventory** from facilities
- Environmental footprint



2) Return to Soil:

- How are **biosolid** amendments affecting **soil health**
- **GHG emissions** from
- How are **microbial communities shifting** under amendments
 - Trends to GHG emissions



Alexis de Laronde
IWM Lab
Dalhousie University

a.delaronde@dal.ca



HALIFAX



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

