

Free-living nitrogen fixation in Saskatchewan Agriculture

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With decades in no-tillage,
is there more free-living nitrogen fixation?

- Some reports locally and from other regions
 - With time in no-tillage, changes in soil profile, aggregate size distribution, bulk density
 - Improved biodiversity and functional diversity
 - Is there significant changes to free-living nitrogen fixation?

- Soils from Central Bute & Swift Current (Brown), and Dena (black)
- Top 10 cm only, 40 fields
- Acetylene reduction assay for nitrogenase activity
- ^{15}N N-fixation rate
- N_{inorg} (exchangeable NH_4 , NO_3) wet extraction 2M KCl
- N_{total} emission mass spec.
- DNA extraction, *nifH* primers 360 bp segment,
 - Illumina MiSeq paired-end
 - Genbank and Silva data bases

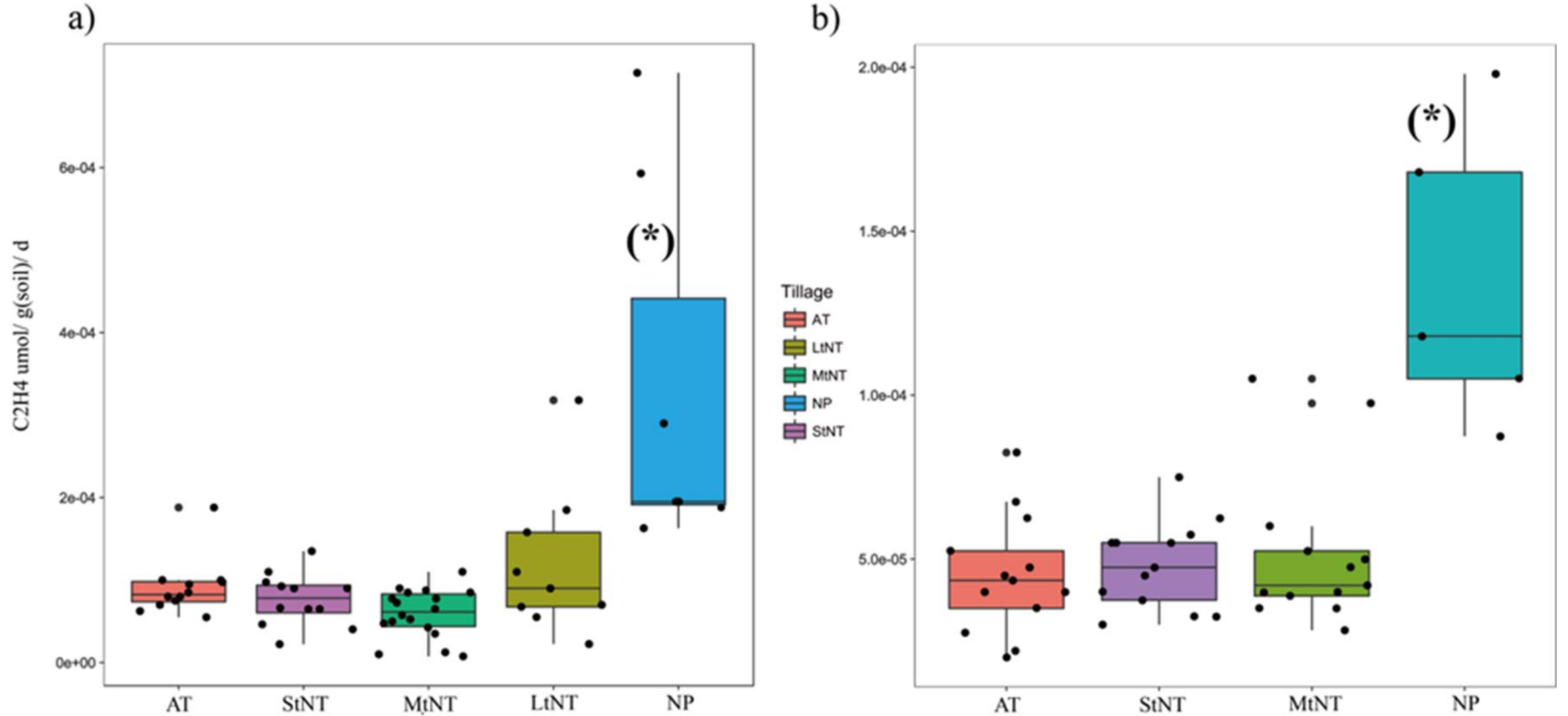
Hypothesis

- Native prairie > 50-60 y NT > 25-36 y NT > 10-15 y NT > tillage

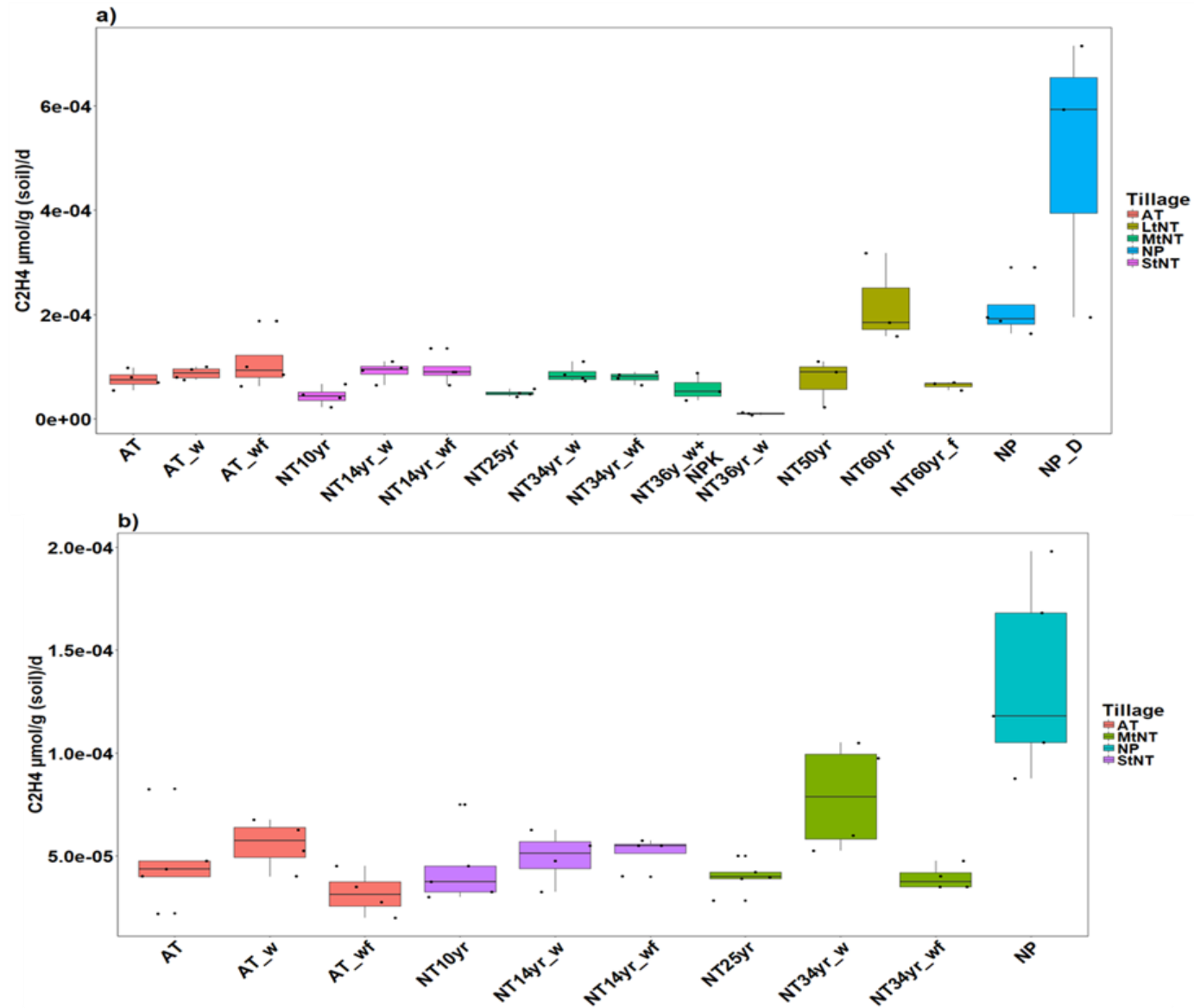
Location	Cropping history	Crop
Central Butte	Native prairie	Grass
	NT 10 y	Pea
	NT 25 y	Pea
	T	Pea
Swift Current	T	Wheat
	NT 14 y	Wheat
	NT 34 y	Wheat
	NT 36 y	Wheat
	NT 36 y;	Wheat
	NT 50 y	Wheat
	T	Wheat
	NT 14 y	Wheat
	NT 34 y	Wheat
	Dana	Native Prairie
NT 60 y (grassland)		Grass
NT 60 y		Wheat

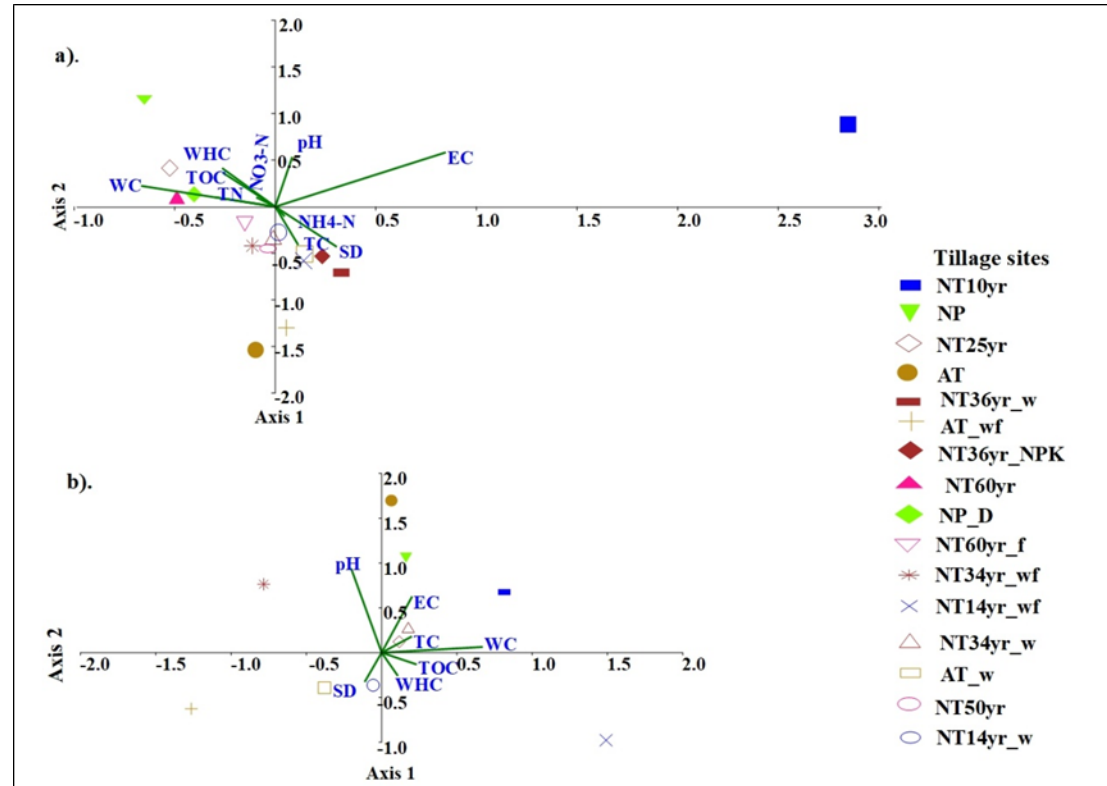
Melfort and Watrous
fields not presented

Acetylene reduction assay

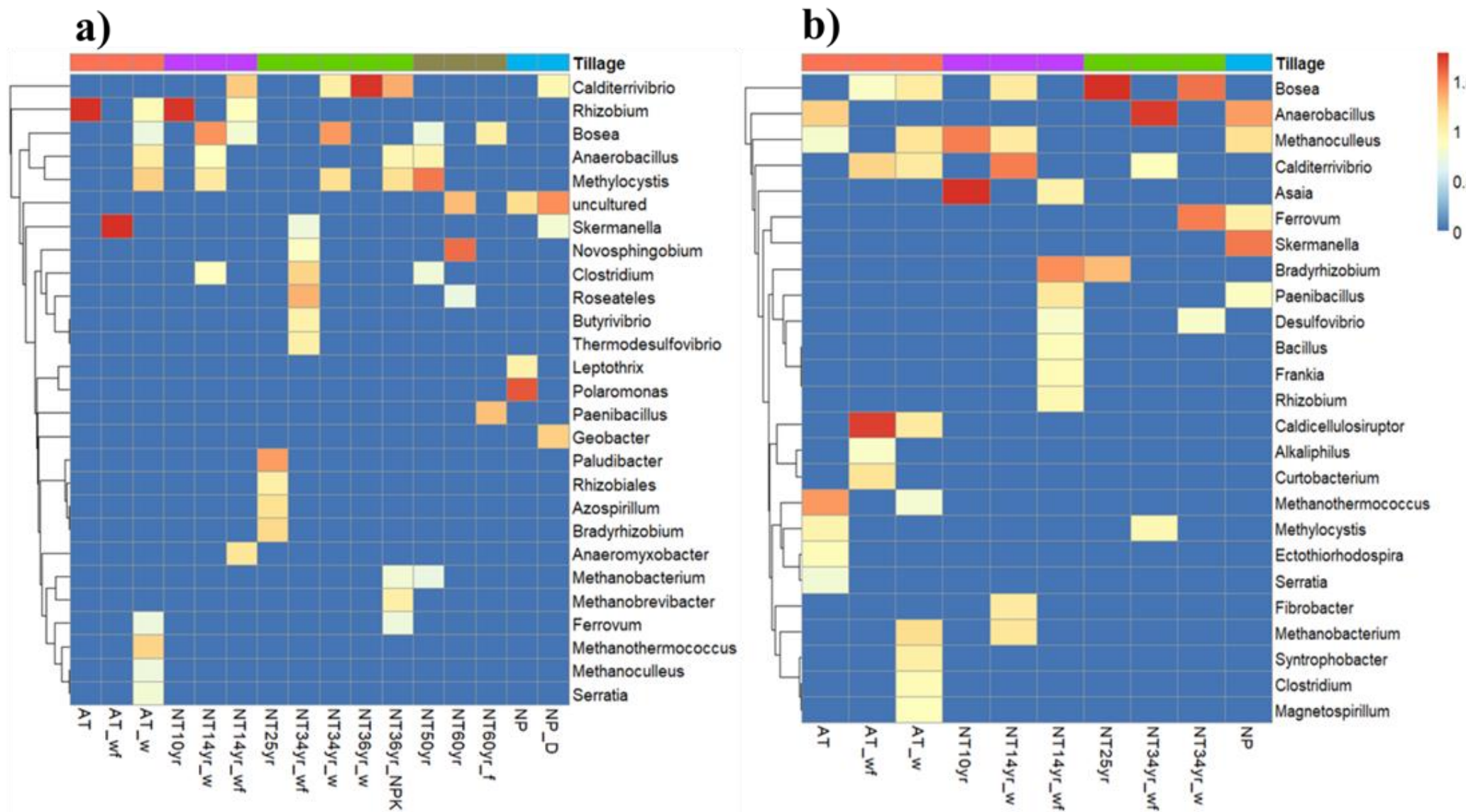


Acetylene, initial rate comparisons

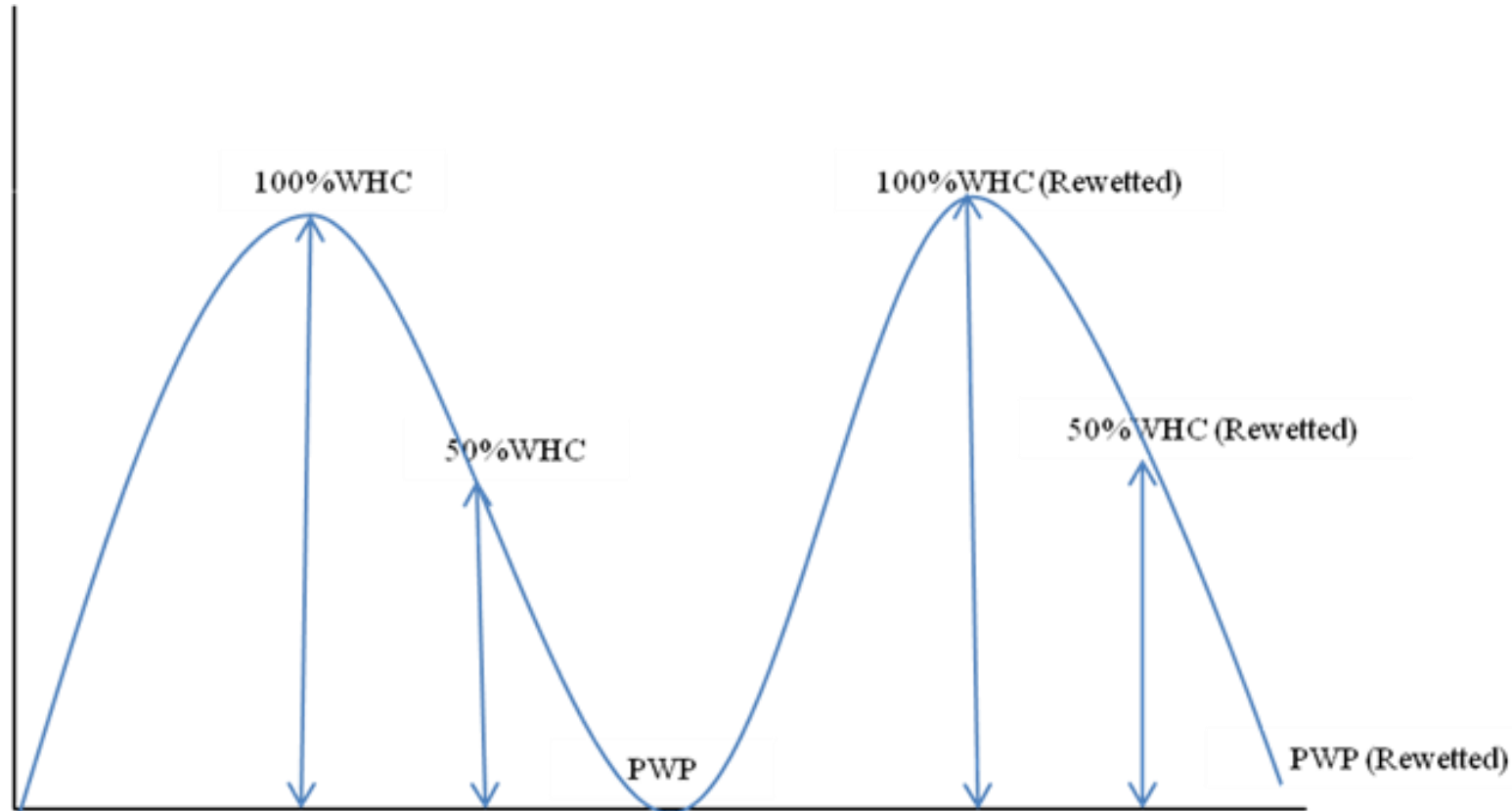




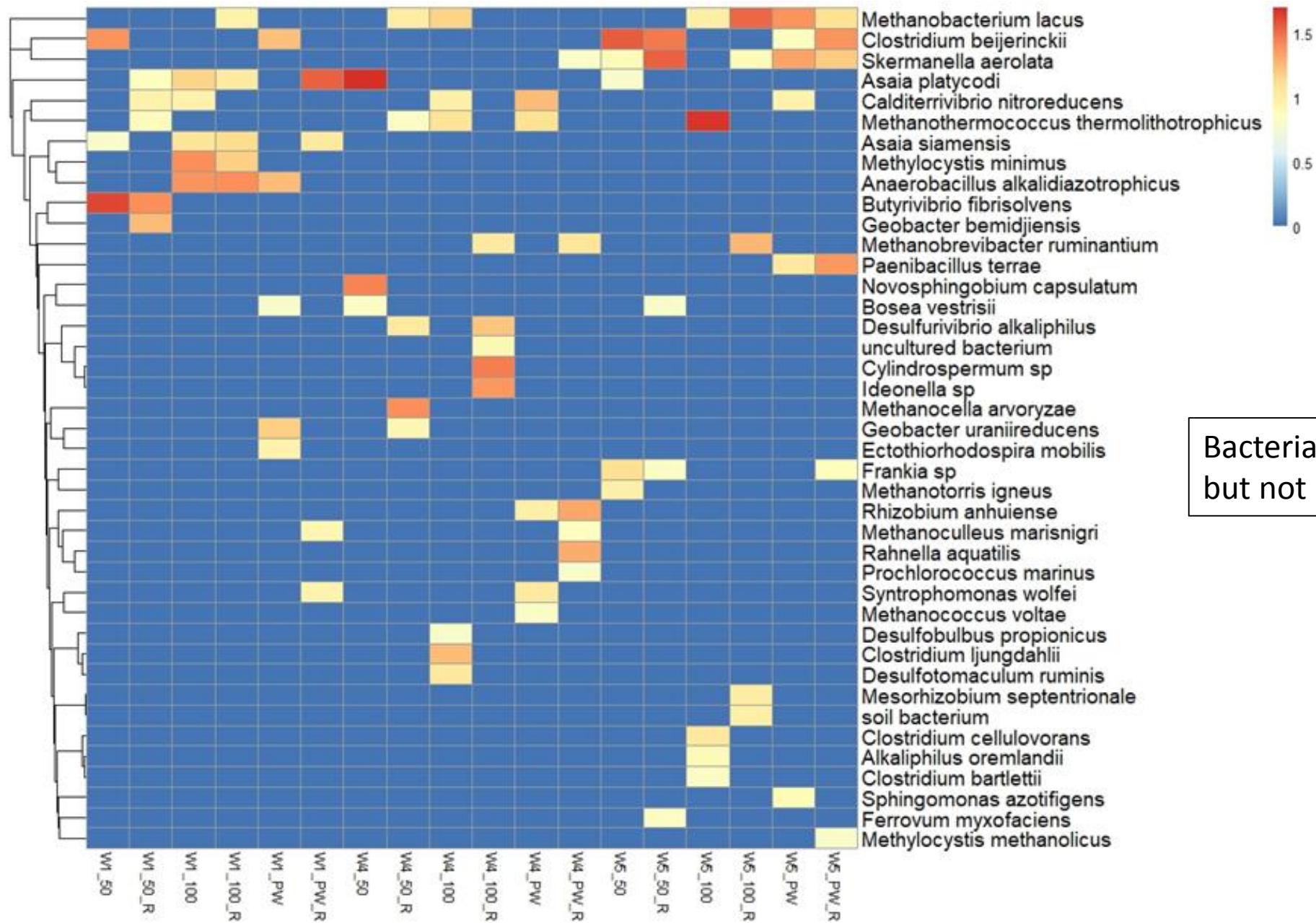
Tillage AT StNT MtNT LtNT NP



Effect of wet-dry cycles on N-fixation



- 9 field soils, 10 y NT
- Proportions of N-fixing genera change
- Do not return to the same community
- Soil texture effect, via drainage rate



Bacteria community responds,
but not in a fixed pattern

Abiotic factors create micro-gradients,
that limit growth range of species

Oxygen concentration
in a soil particle

