AME Association for Mineral Exploration

Geoscience BC

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Presenting at the

Summary of Activities 2020

Minerals

Thursday, May 20

9:00 AM - 11:00 AM PT

Genomics Solutions for Ecosystem Reclamation Following Mine Closure: Topsoil Stockpiles and Biodiversity

Project leader - Dr. Lauchlan Fraser
MSc Student – Ashley Fischer
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Post Doc – Dr. Jay Singh

newgold™ New Afton Mine

Teck

Genome BritishColumbia

THOMPSON RIVERS UNIVERSITY

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INTRODUCTION: TOPSOIL STOCKPILES

- Source of native seeds, nutrients, structure, and symbiotic microorganisms
- Topsoil is stripped and stored on site for post-mining restoration
- Storage may damage soil quality hindering restoration, but more information is needed

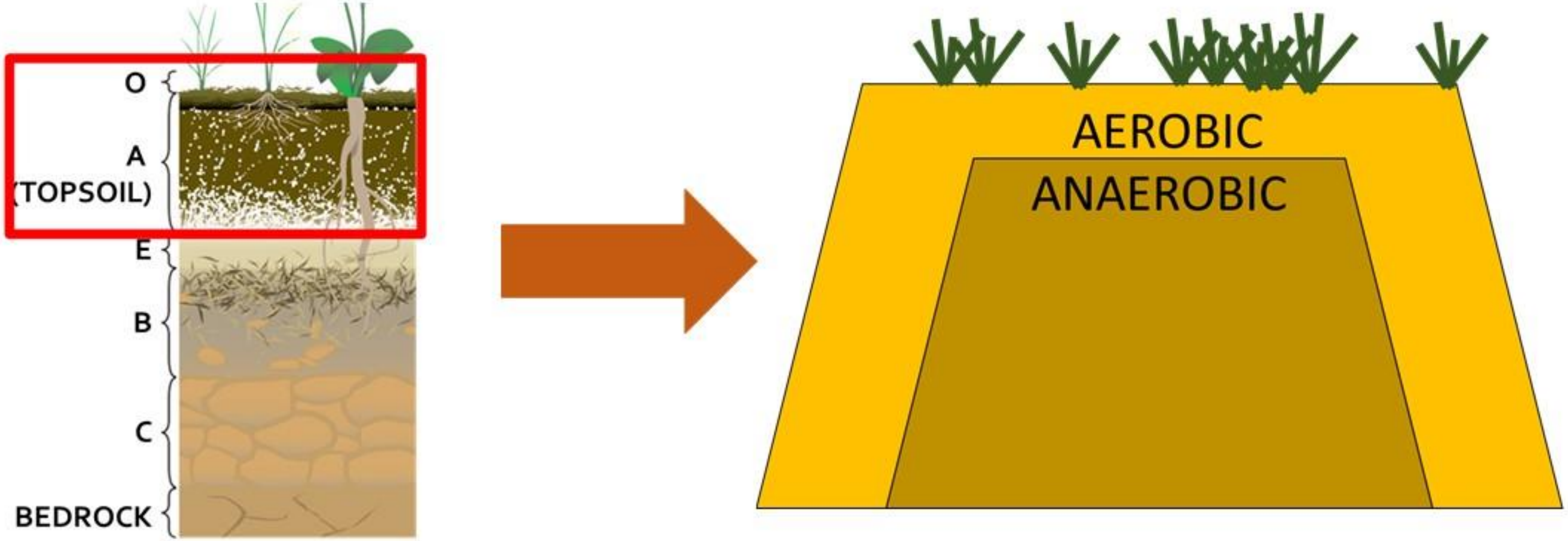


Figure 1. Diagram of topsoil stockpile storage

INTRODUCTION: OBJECTIVES

Assess geochemical properties and soil microbial communities with stockpile depth

- Improve knowledge on how topsoil stockpile height impacts soil quality
- Provide information and suggestions to industry, that may improve reclamation practices
- Understand environmental impacts of disturbance on soil

Figure 2. Sampling of topsoil stockpile

METHODS: SAMPLING

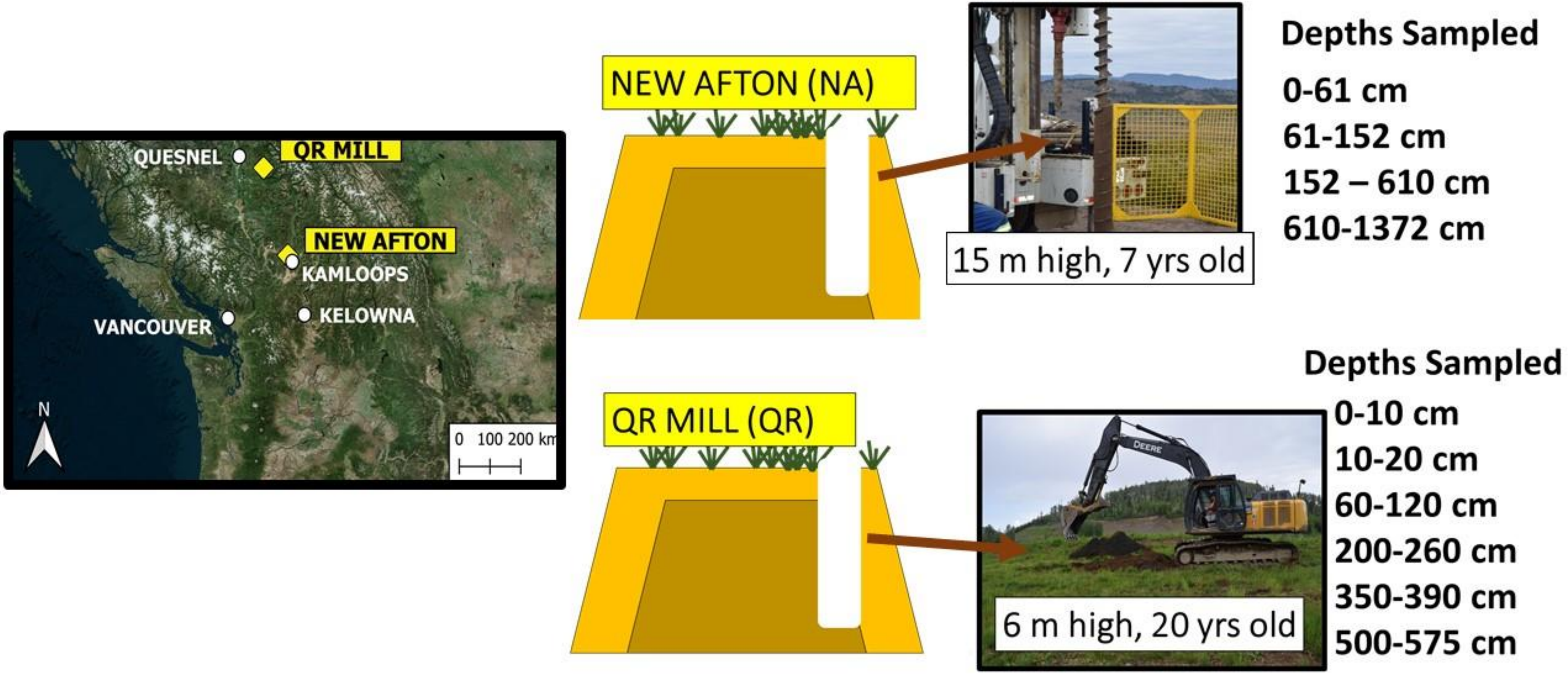


Figure 3. Sampling locations and depths of topsoil stockpiles

METHODS: SOIL ANALYSES

Geochemical changes with depth

N	NITROGEN
P	PHOSPHORUS
K	POTASSIUM
NO3	NITRATE
NH4	AMMONIUM
OM	ORGANIC MATTER
pH	ACIDITY
Ca	CALCIUM
Fe	IRON
Mg	MAGNESIUM
Mn	MANGANESE
S	SULPHUR
Cu	COPPER
EC	ELECTRICAL CONDUCTIVITY

Figure 4. List of key geochemical properties measured

Microbial changes with depth

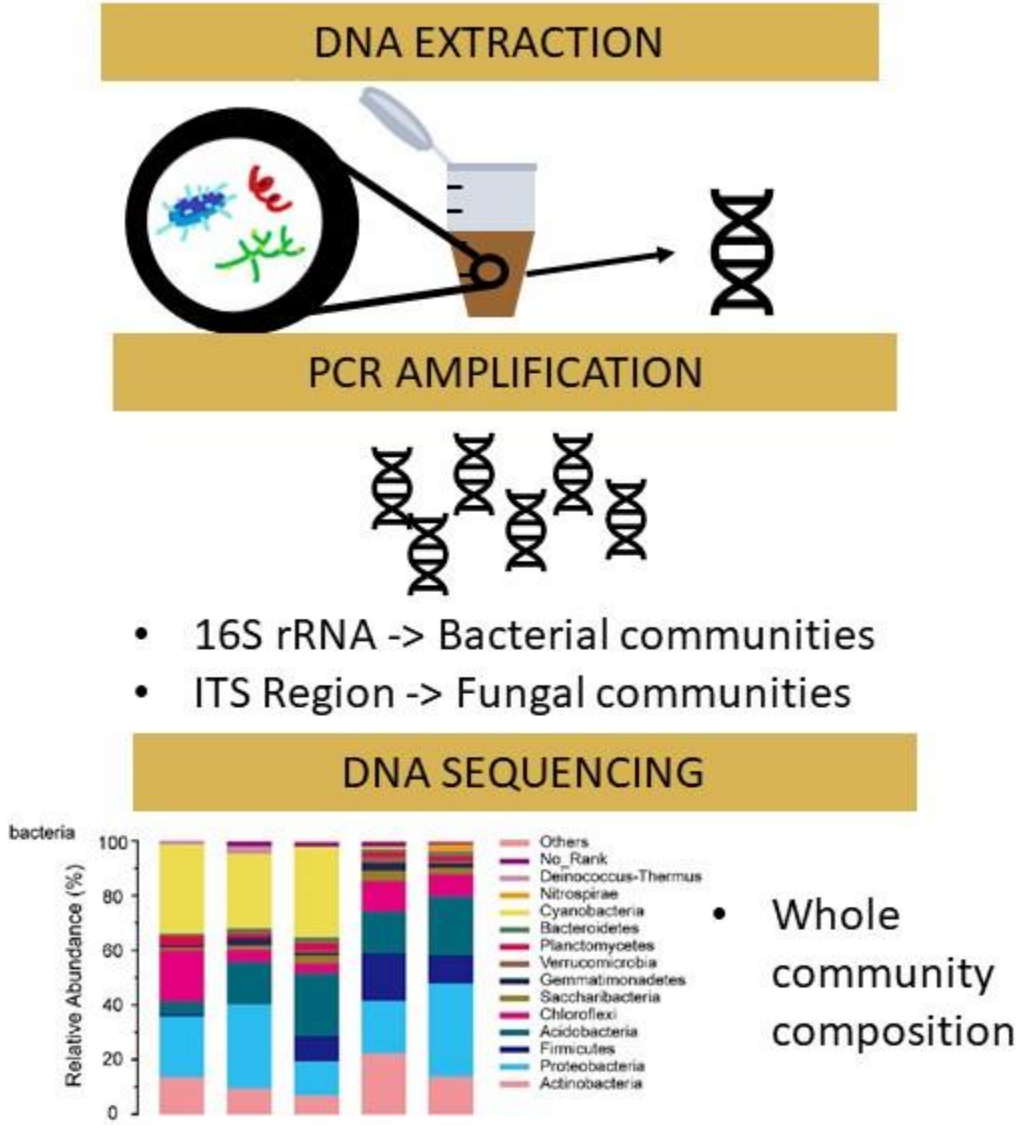


Figure 5. Diagram of sequencing process

RESULTS: CHEMICAL PROPERTIES

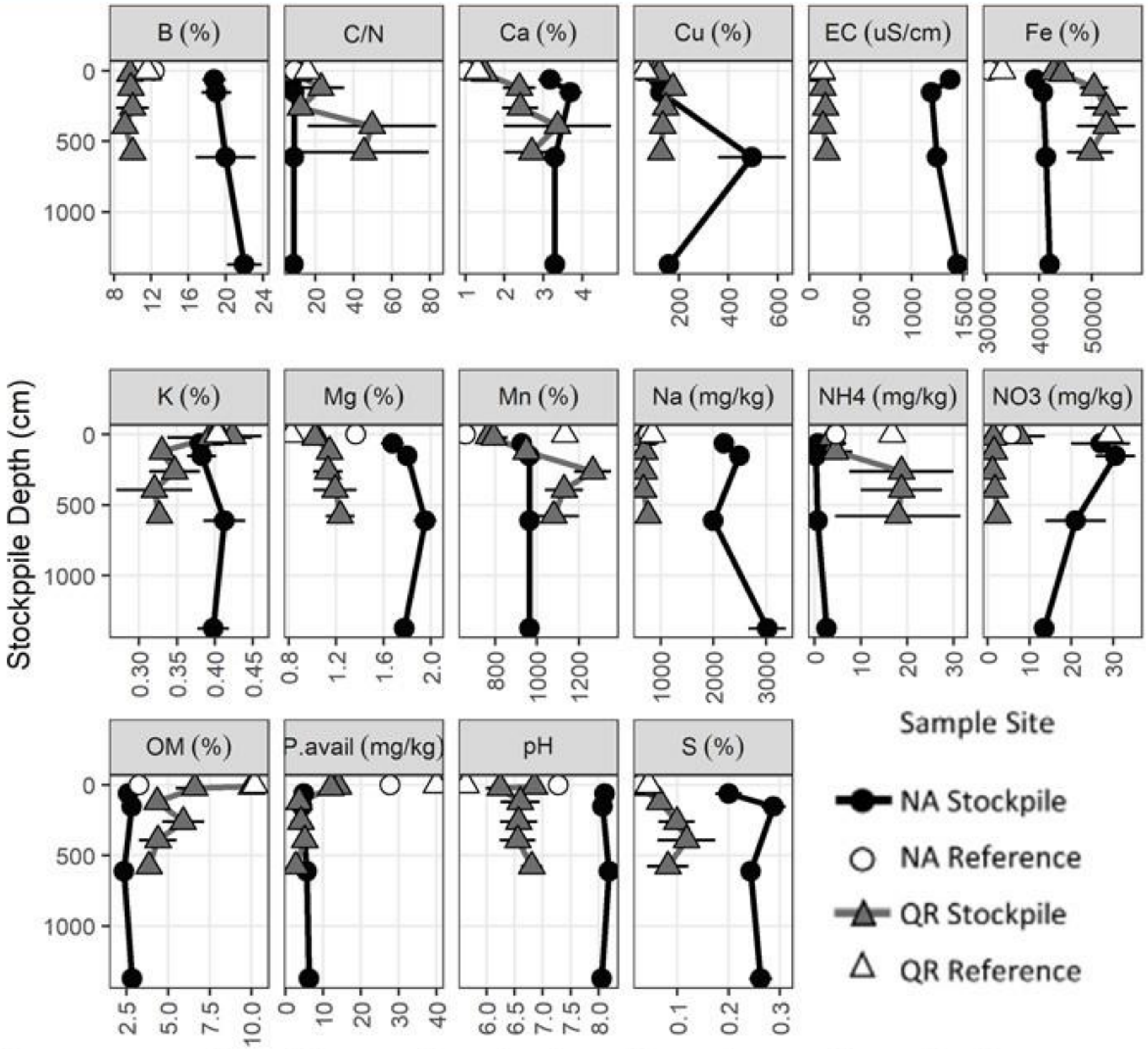


Figure 6. Stratigraphic geochemical profiles of topsoil stockpiles

Changes With Increasing Depth: General Trends

<u>Decrease in:</u>

NO3(NA), Na(NA), B(NA), K(QR), OM(QR), Avail P(QR)

<u>Increase in:</u>

Cu(NA), Fe(NA), NH_4(NA,QR)

RESULTS: MICROBIAL COMMUNITY

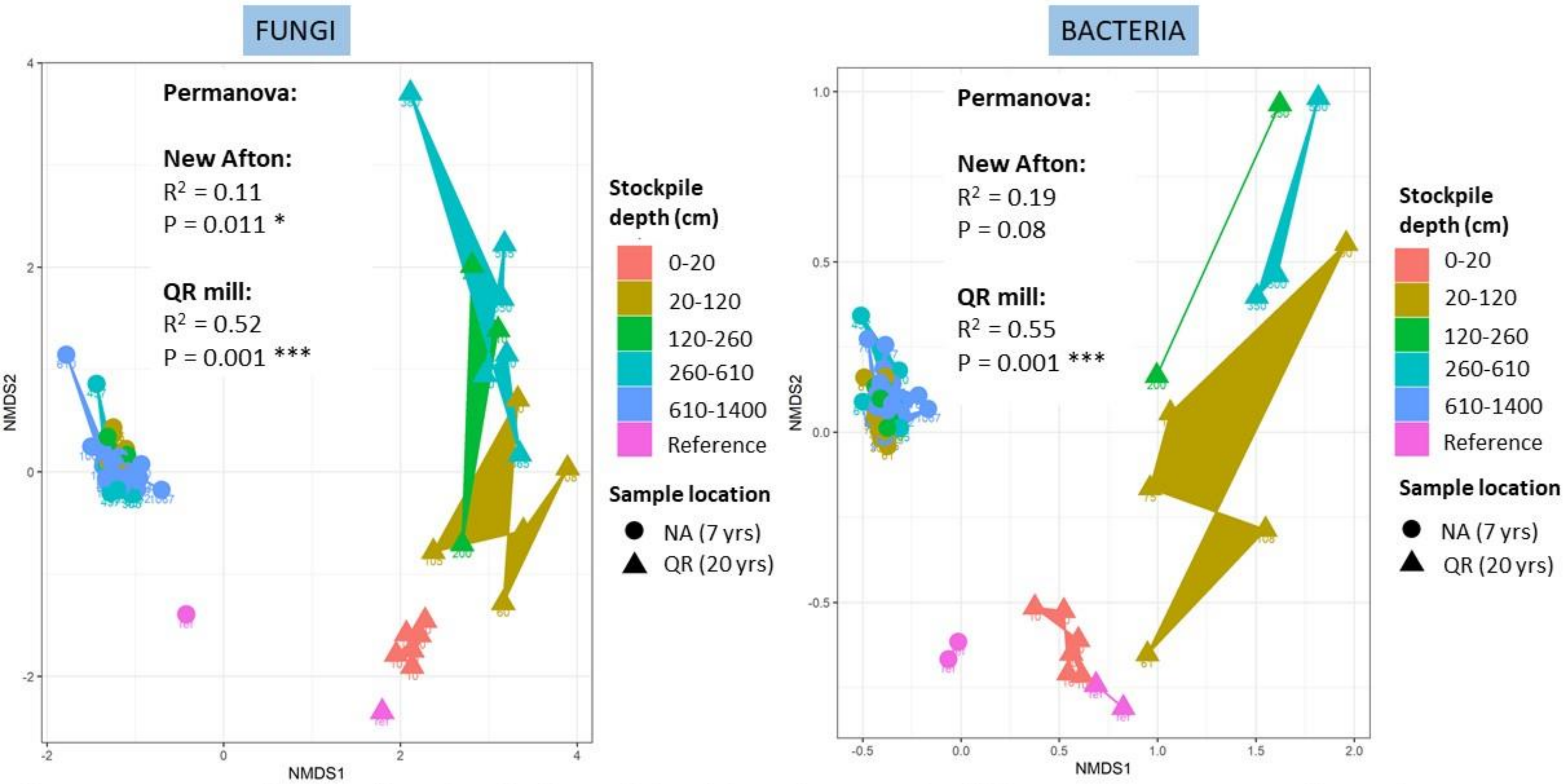


Figure 7. NMDS ordination plots showing bacterial and fungal community differences between topsoil samples



Invertebrate Focus

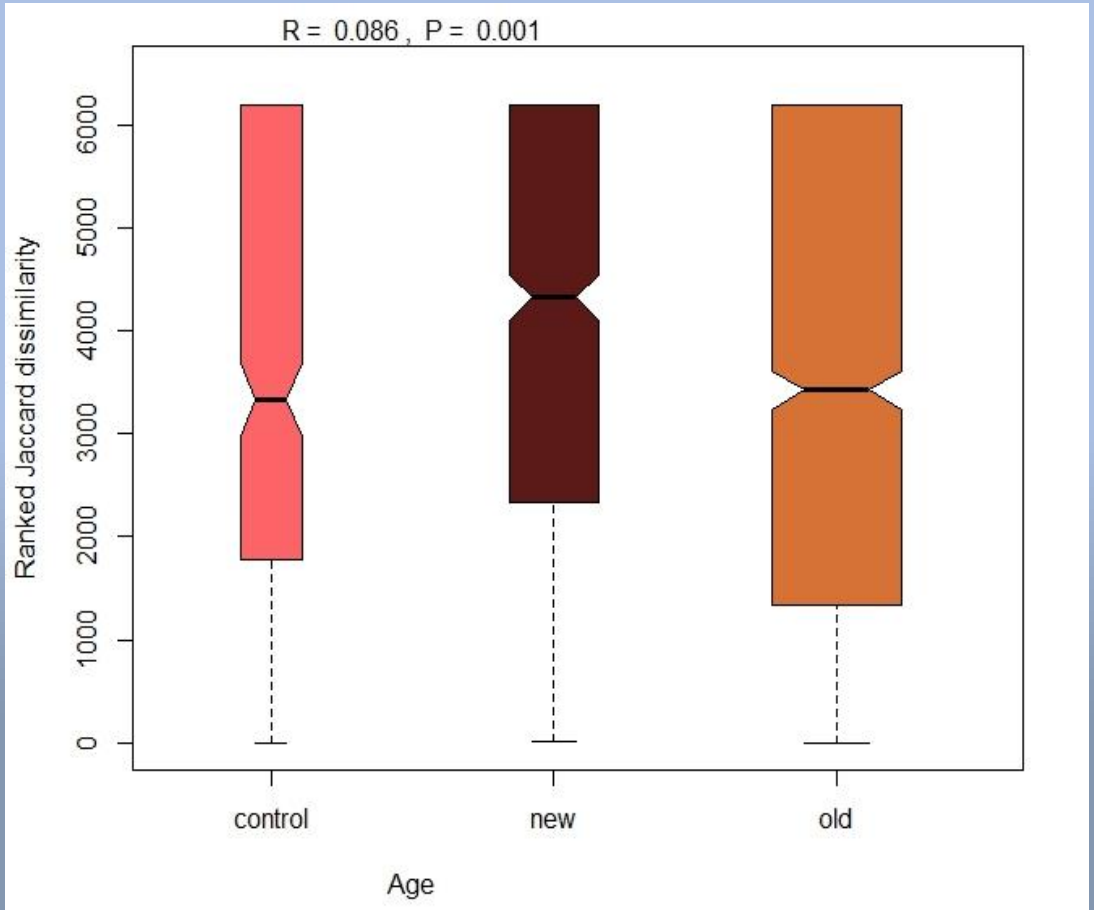
- **Plant and ecosystem functioning**
- **Sensitive to the environment**
- **Largest animal biomass**

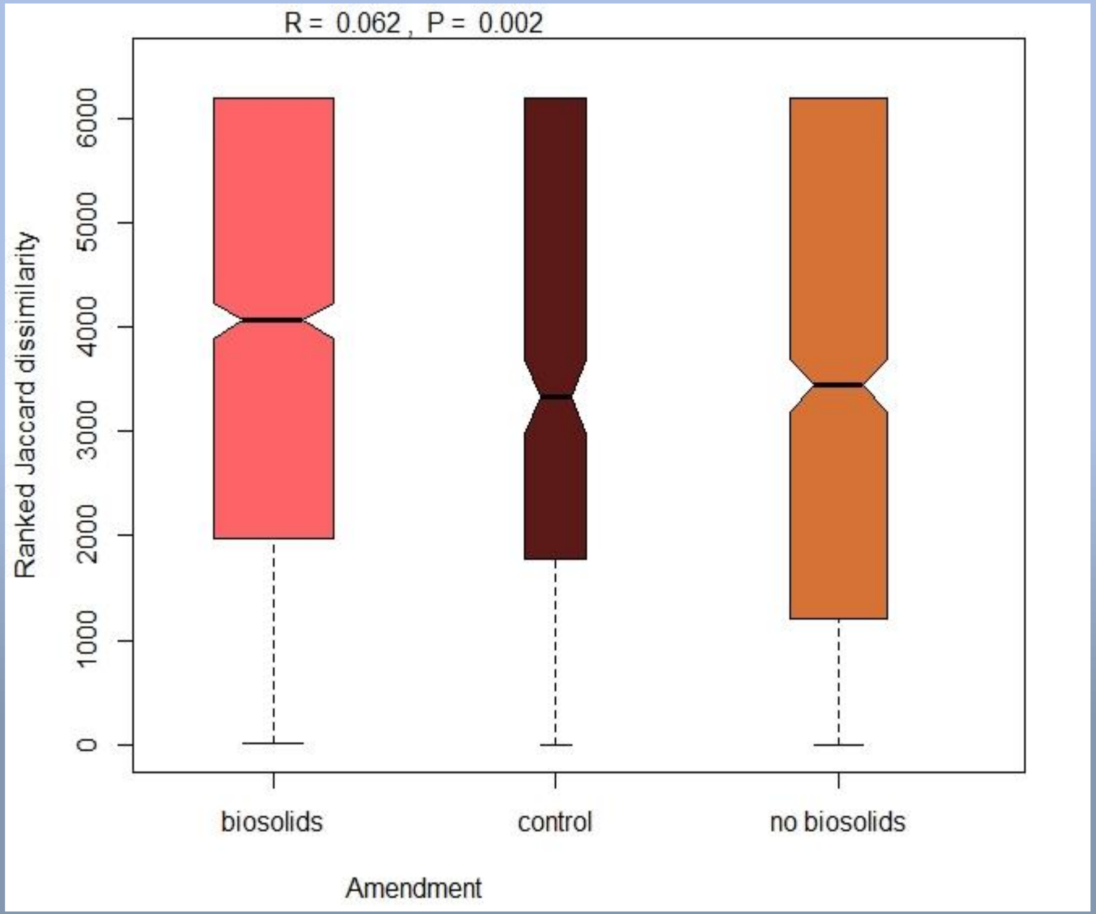
Objectives

Monitor reclamation trajectory

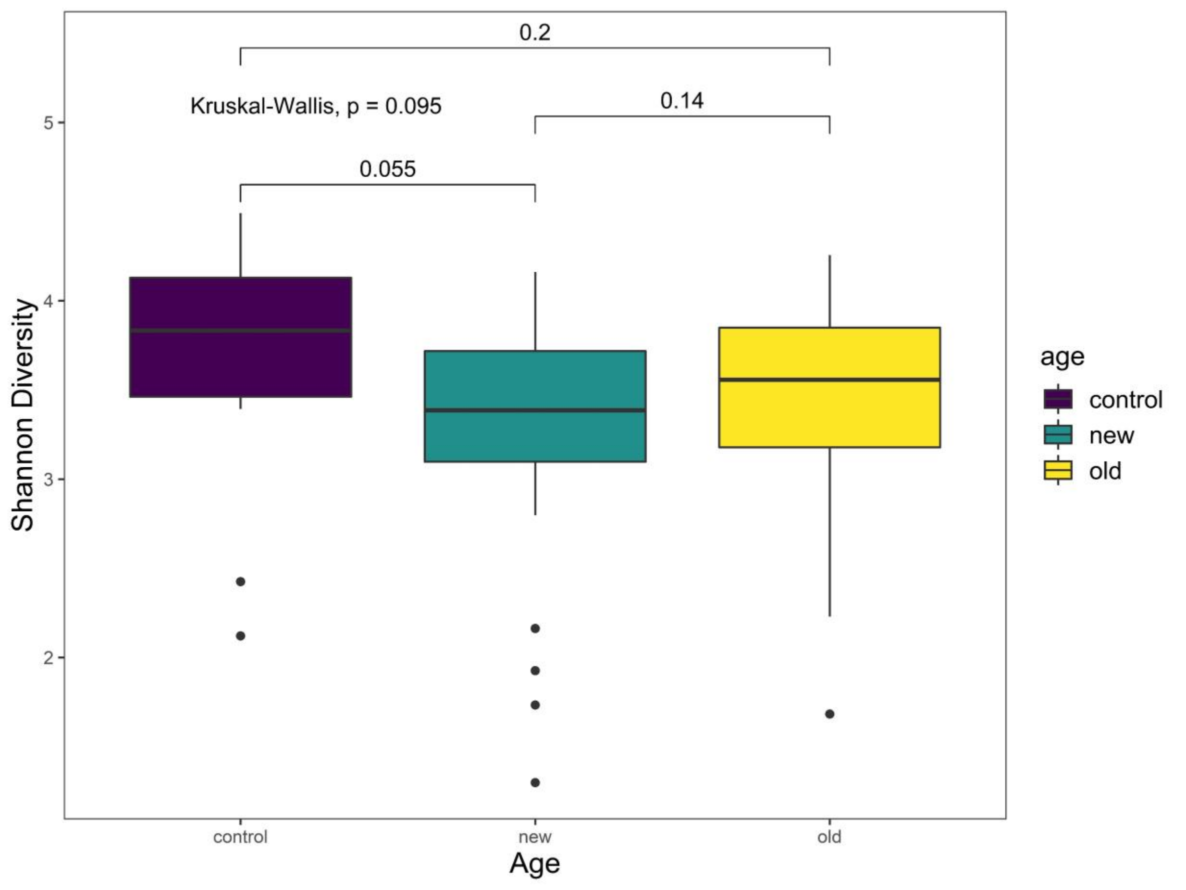
Evaluate invertebrate community composition

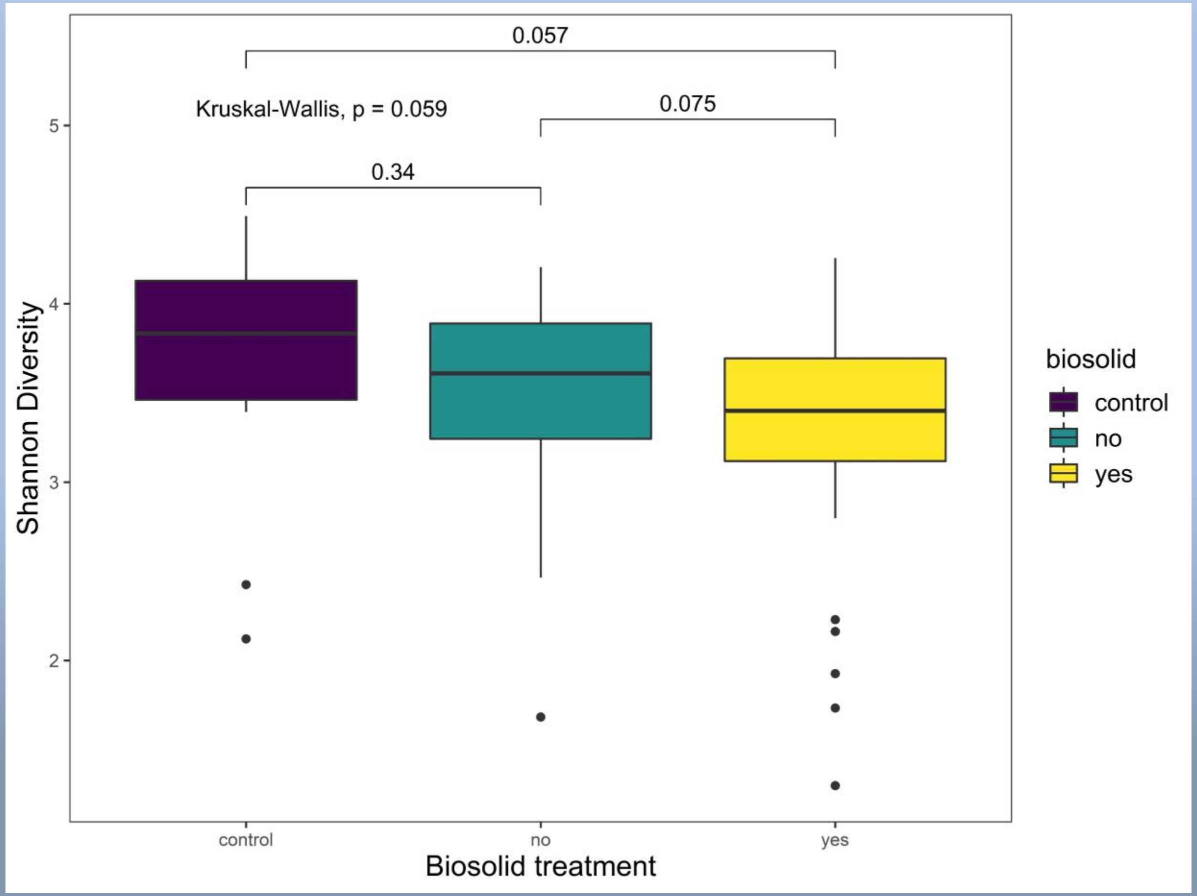
Invertebrate community was significantly associated with age and amendment





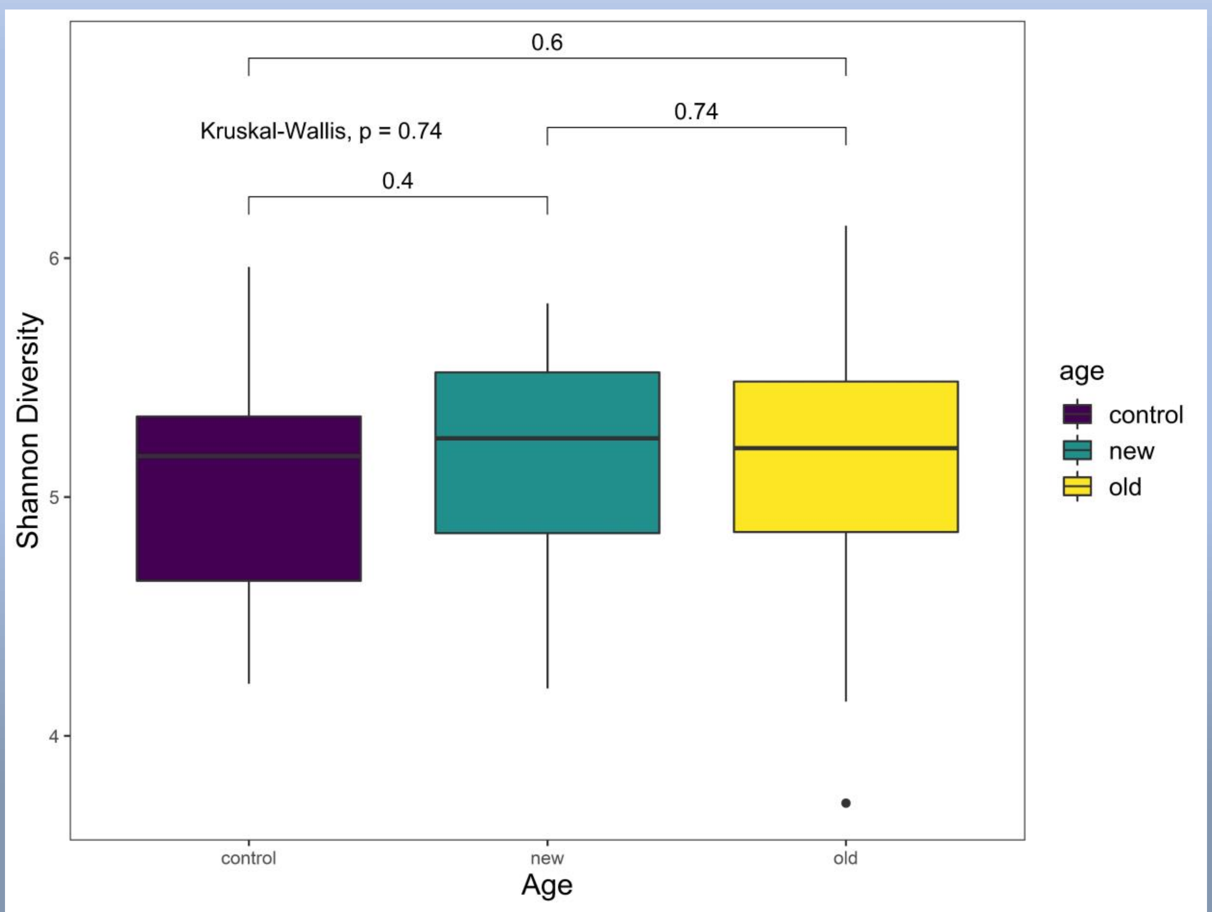
How microbial biodiversity metrics are impacted?

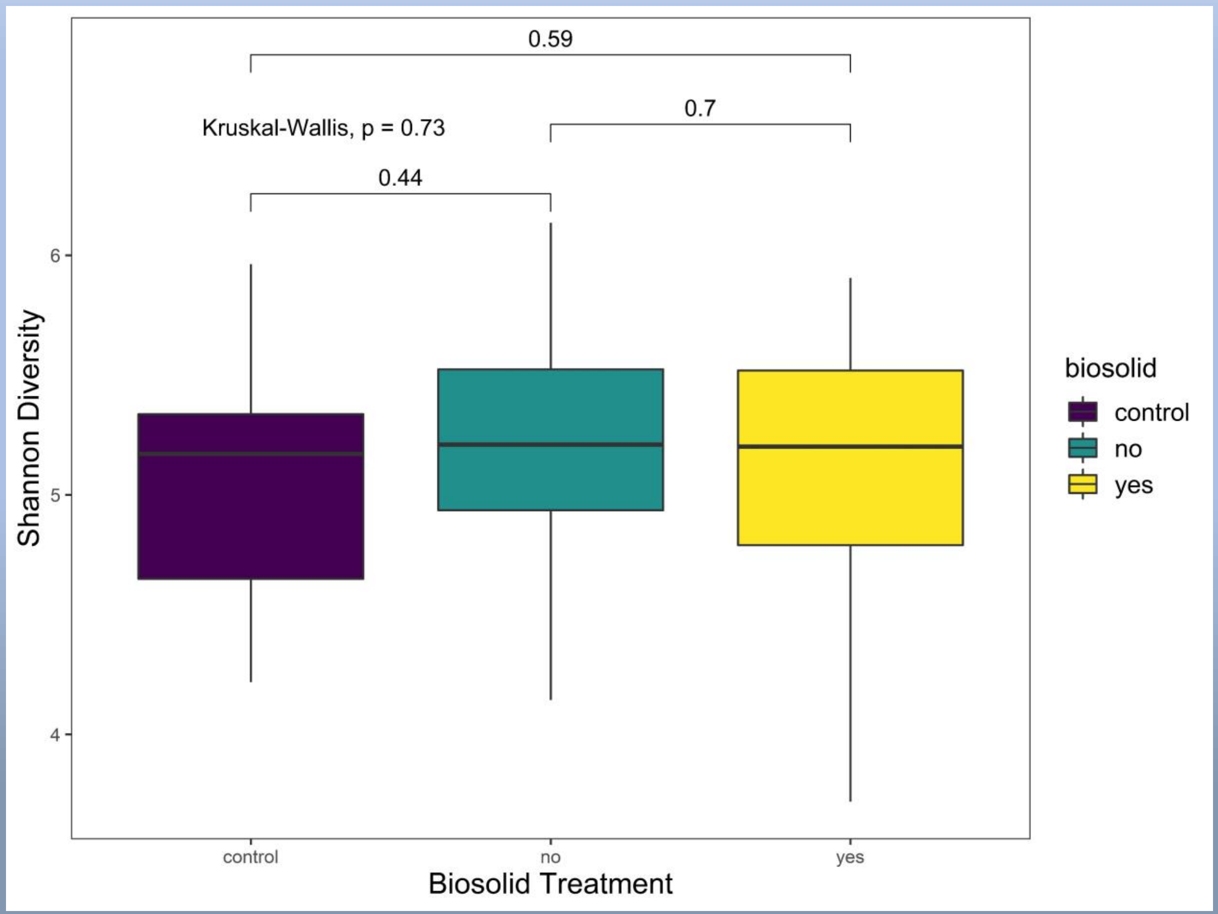




Fungal Shannon diversity

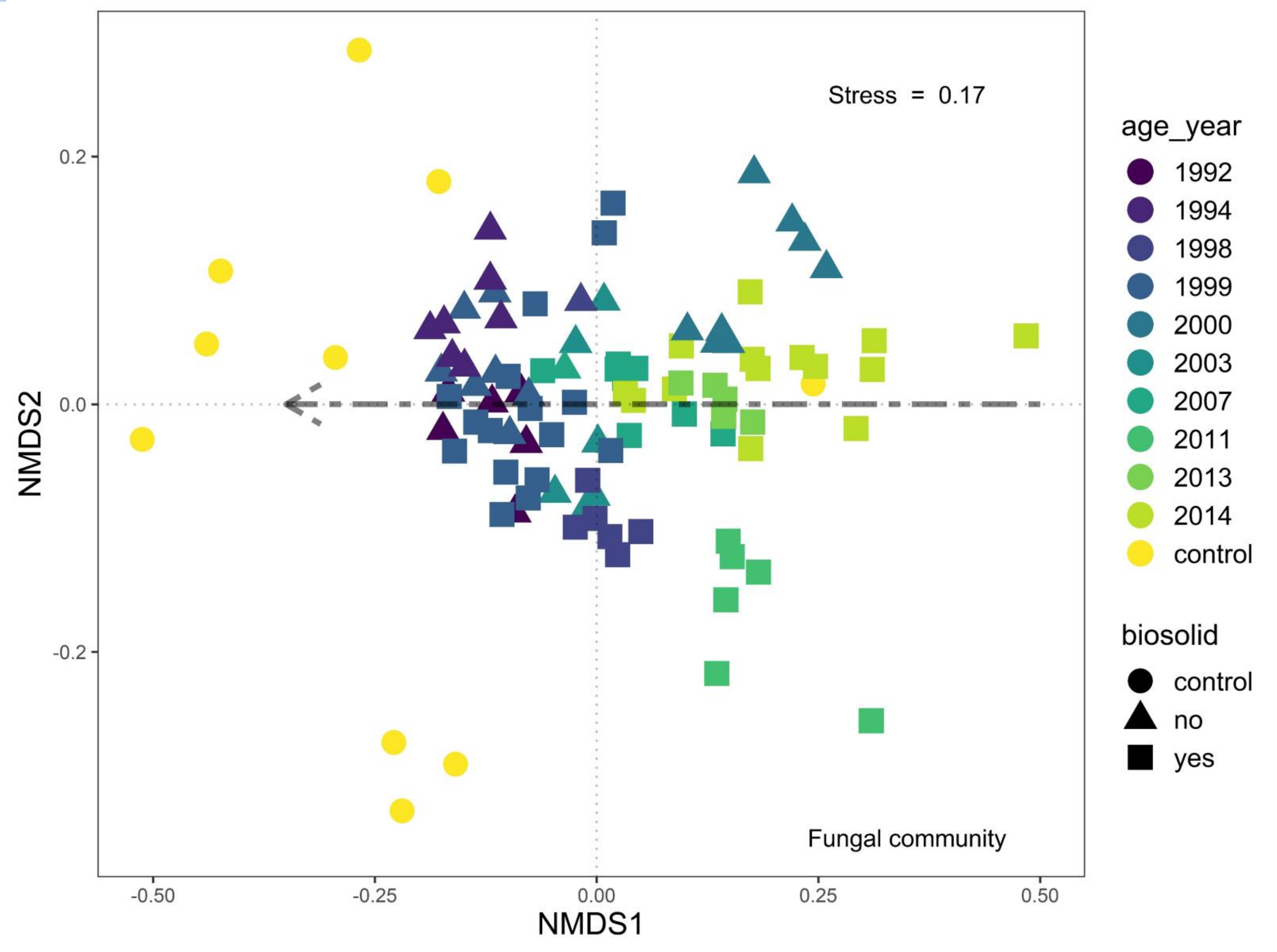
How microbial biodiversity metrics are impacted?





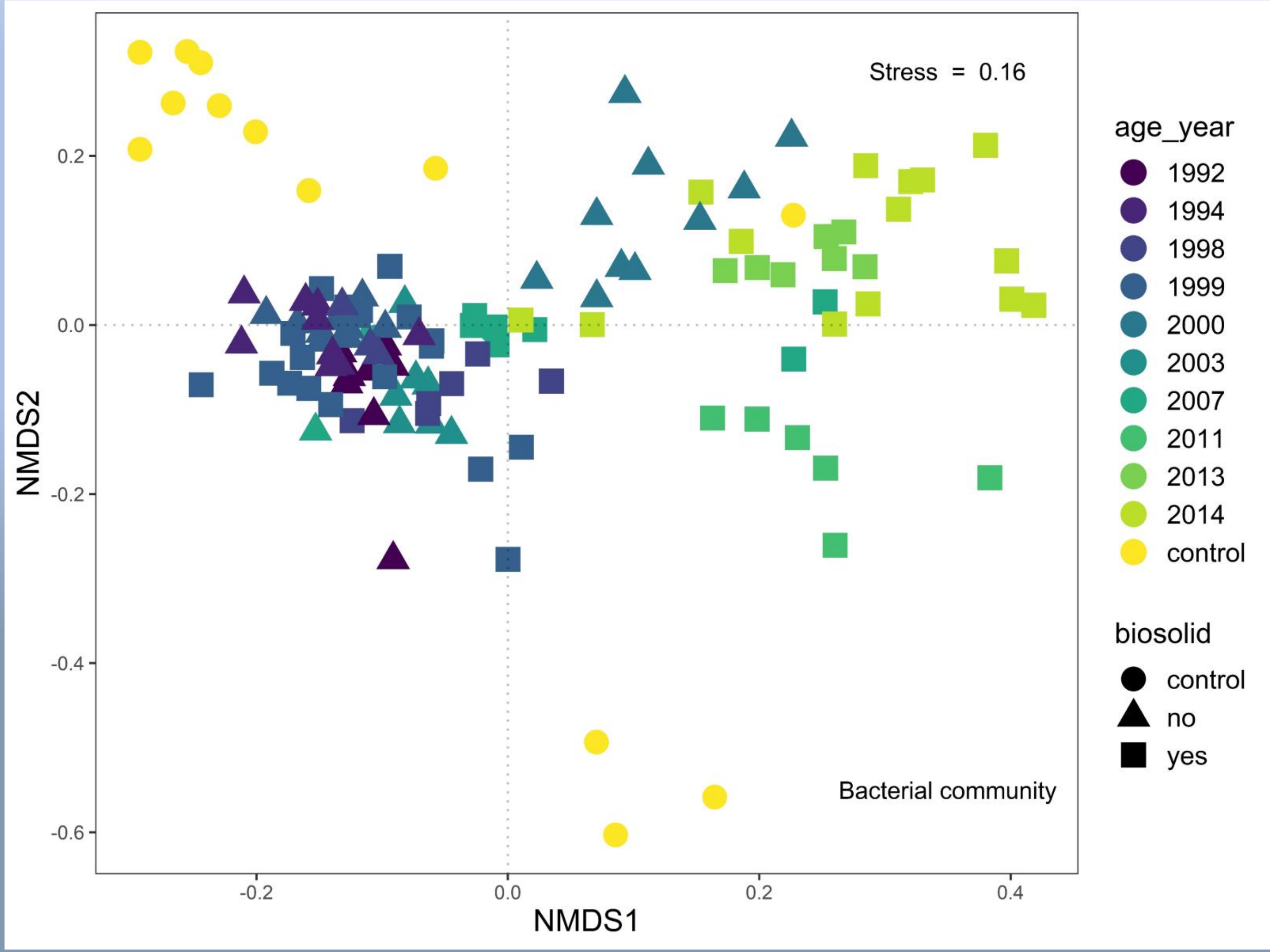
Bacterial Shannon diversity

How do reclamation strategies and time since reclamation impact microbial community composition?



- Biosolid treatment (i.e. presence and absence) was a significant predictor of microbial community composition
- The trajectory of microbial community composition moved towards the control (reference site)
- Importantly, age since reclamation is the major determiner of this trajectory
- From the data, it appears that regardless of the reclamation strategy if a reclaimed site is given adequate time fungal community may become similar to the reference site

How do reclamation strategies and time since reclamation impact microbial community composition?



Similar response as the fungal community where the bacterial community composition appears to be moving towards the reference site with age

Conclusion

- Microbial communities were significantly associated with depth at the stockpiles
- Invertebrate community were significantly associated with age and amendment
- Although significantly different microbial community from site with different reclamation strategies trends towards reference site
- Given enough time (since reclamation) microbial community at reclaimed sites can potentially recover to native (reference) state

Current Work

- Analysis of metagenomics sequences
- Explore association with functional potential with age of reclamation and amendment application

Thank you