

## Background

- Interest in the production of renewable energy from plants has increased in the last decade
- Crop biomass can be used as an alternate source
- Switchgrass (*Panicum virgatum*) is a warm season C4-perennial crop gaining in popularity for bio-fuel on marginal lands (Gelfand *et al.*, 2013)
- Proper nitrogen (N) management and landscape positions (slope) are key factors in impacting the production of switchgrass
- Little is known about the fertilizer management and soil health under switchgrass.
- Thus, the objective of this study was to assess the responses of soil microbial communities and metabolic activities relevant to C, N, P and S cycling in soils to N management using a next-generation sequencing approach and landscape positions in switchgrass.

## WORKFLOW

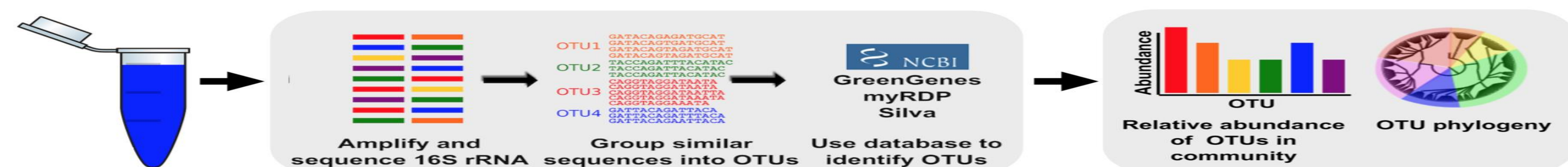
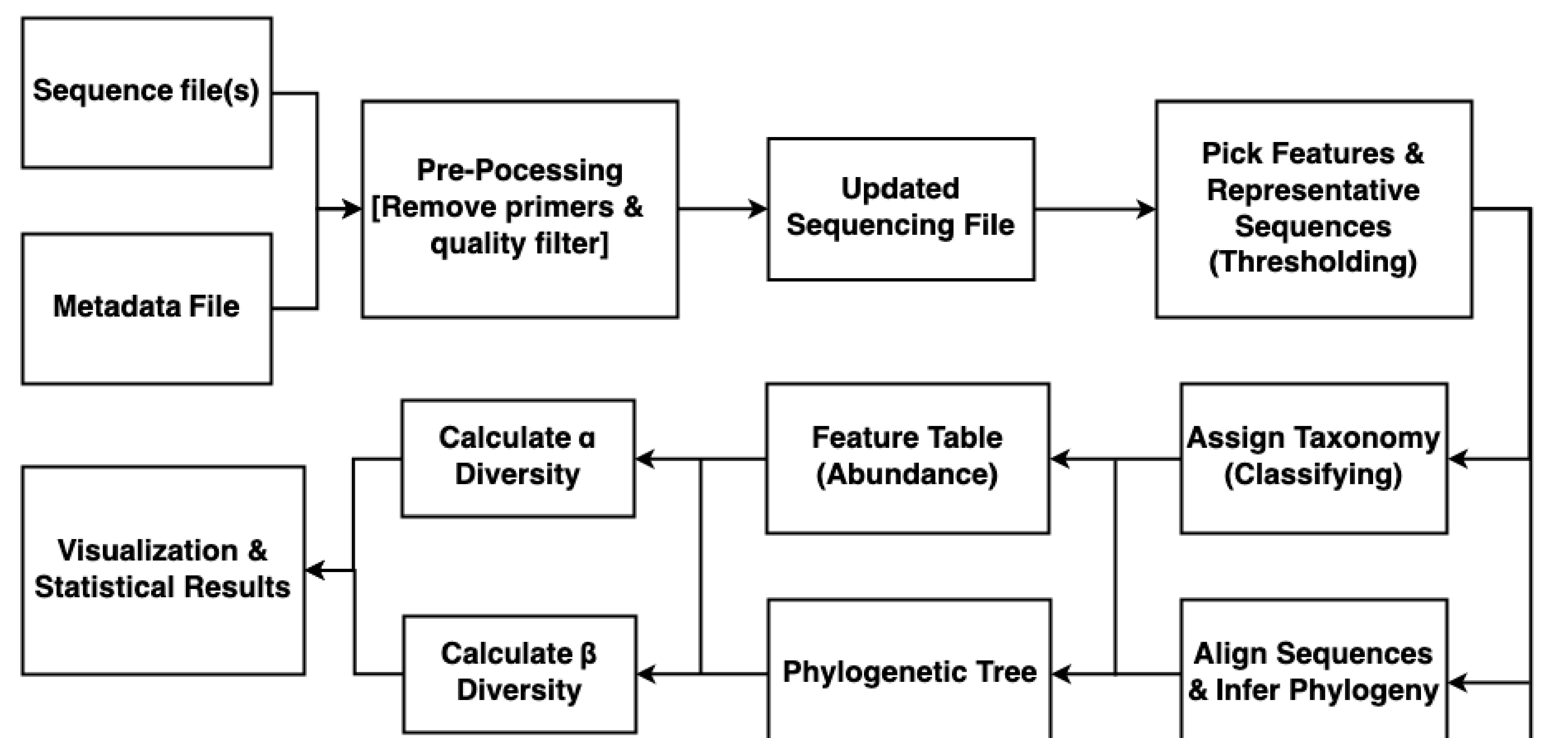


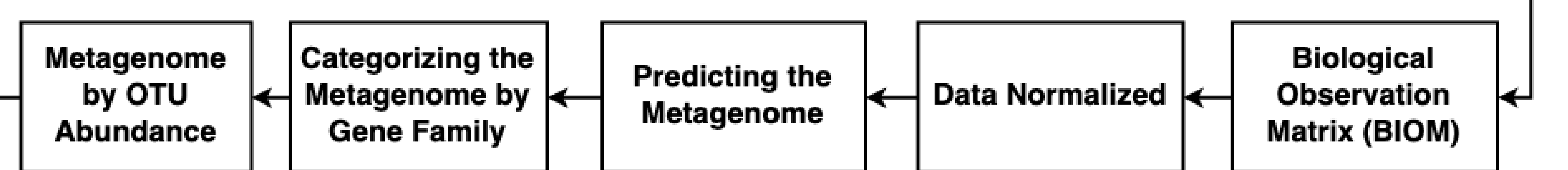
Figure 1: Steps of extracting Gene Sequencing and Operational Taxonomic Units (OTU) abundance information

## Results

### Platform: Qiime-2



### Platform: PICRUST



### Platform: RStudio

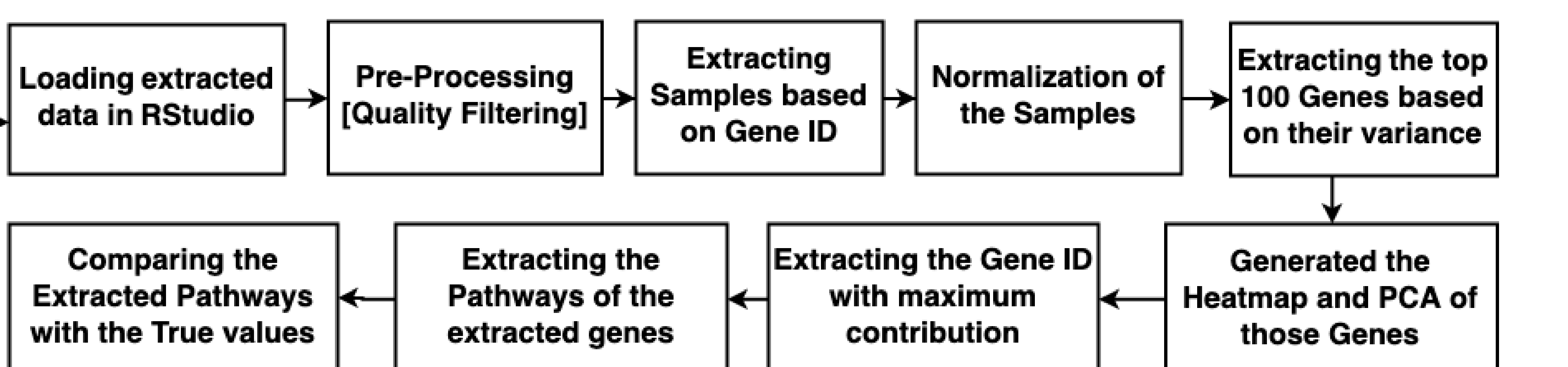


Figure 2. Flowchart for data analysis stages of DNA sequencing files using QIIME-2 and PICRUST platforms.

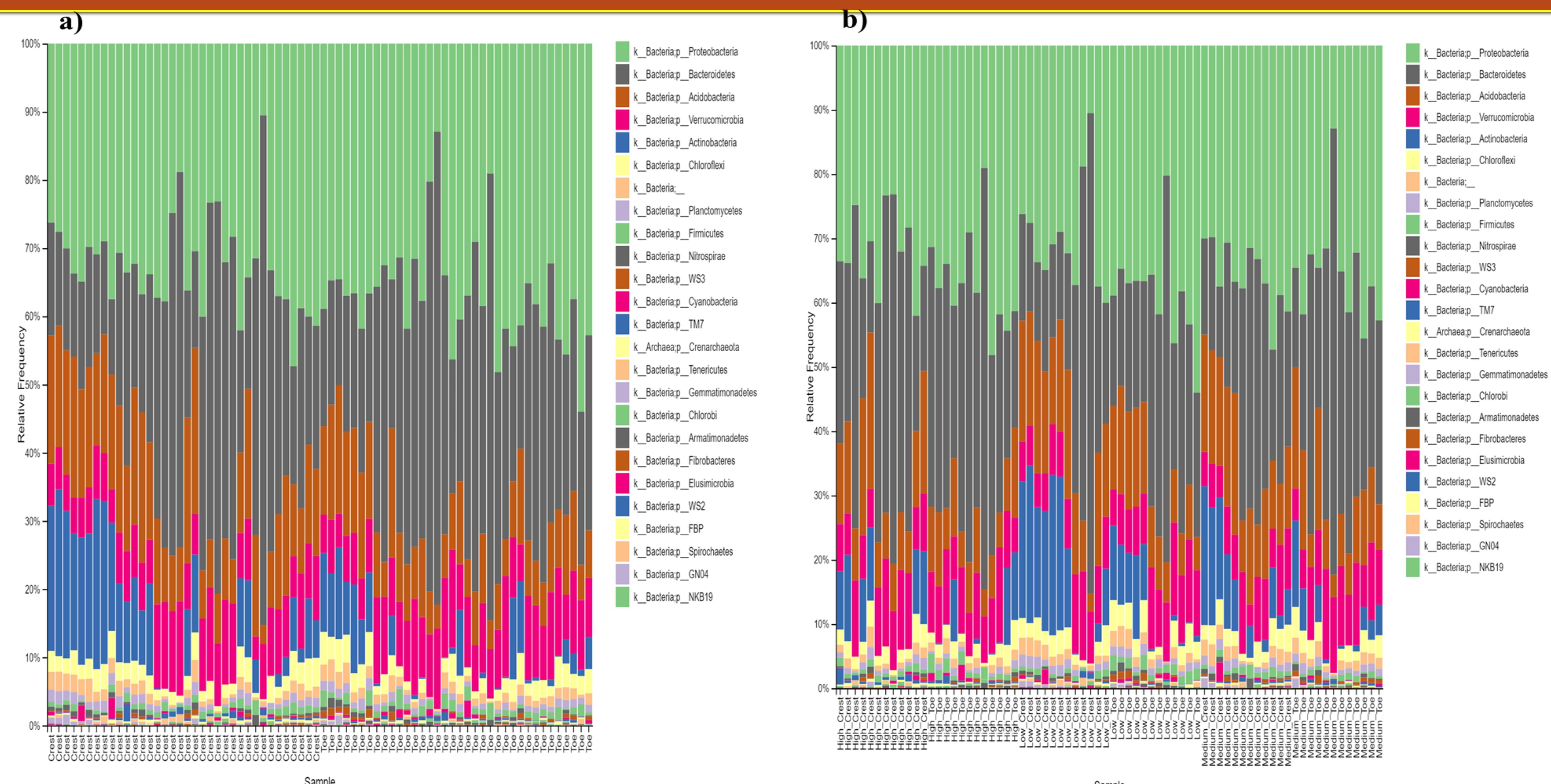


Figure 3. Bacterial composition of different treatments at phylum level. Each bar represents the relative abundance (%) of each bacterial taxon at a) Shoulder and Footslope landscape position, b) High N\_Shoulder, High N\_Footslope, Low N\_Shoulder, Low N\_Footslope, Medium N\_Shoulder, and Medium N\_Footslope treatments.

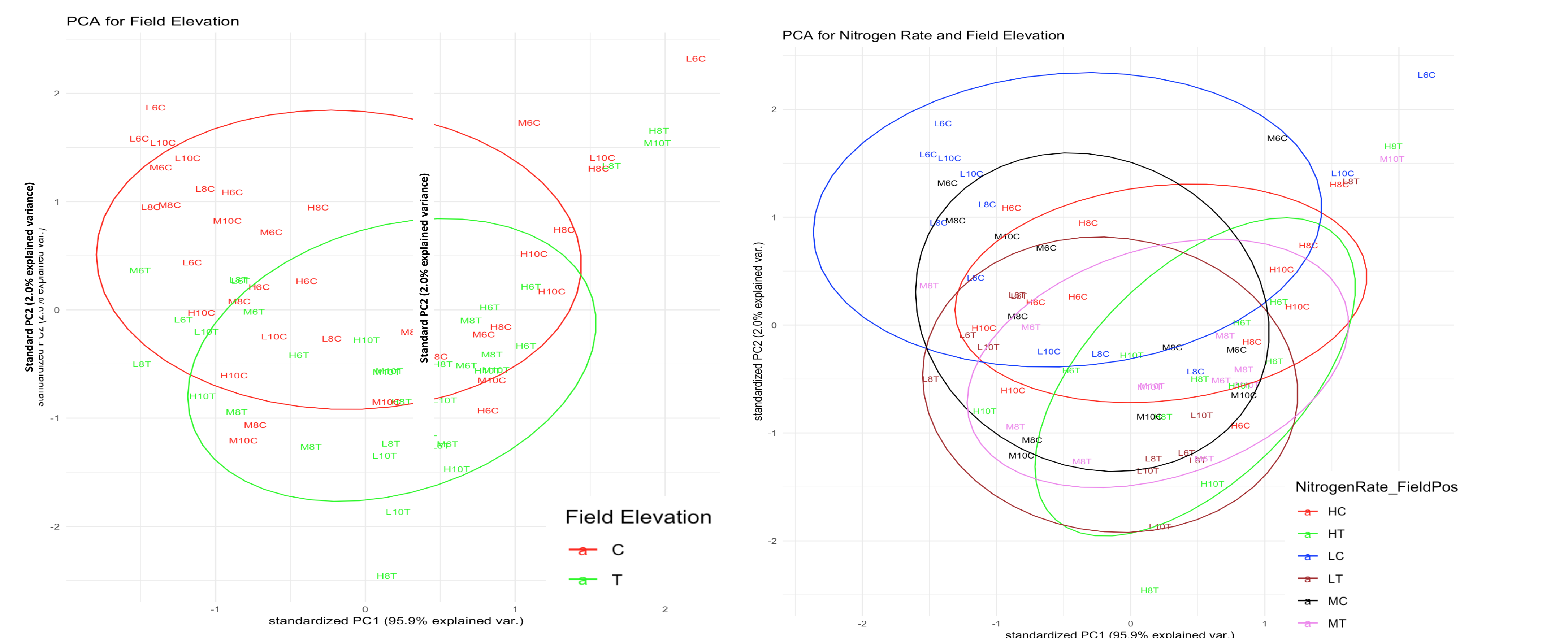


Figure 4. PCA plots of metabolic pathway enrichment patterns indicating largest difference influenced by field position (left), and the interaction in low nitrogen rates. The 1<sup>st</sup> PC is 95.9% and the 2<sup>nd</sup> PC is 2.0%.

## Conclusions

- Phylum level relative abundance shown in Fig-3 indicates that there were large differences in bacterial composition among samples.
- The clustering patterns base on relative enrichment of the most variant metabolic pathway (KEGG) IDs in Fig-4 indicated that field position had the largest impact on enrichment of metabolic pathway IDs.
- Evaluation of major contributors to the PC1 axis identified various metabolic pathways largely different between the samples.

### Reference

Gelfand I, Sahajpal R, Zhang X, Izaurralde RC, Gross KL, Robertson GP (2013) Sustainable bioenergy production from marginal lands in the US Midwest. *Nature*, 493, 514.

### Acknowledgements

- Department of energy, USDA-NRCS (grant no. G17AC00337).
- US Geological Survey, South Dakota Cooperative Fish & Wildlife Research Unit (RWO 116)
- We thank Mr. Jerry Roitsch for providing the land for the study.