



Environmental DNA as a Tool for Assessing Microbial Diversity & Ecological Impacts by Contaminants at a Brownfield Site in Southern California



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Introduction

- Brownfield sites are properties with the presence of hazardous substances, pollutants, or contaminants. These sites tend to be found in economically deprived and primarily minority communities
- Environmental DNA is a novel technique, where a sample of air, soil, or water can be processed to amplify traces of DNA from feces, hair, skin, etc. to detect organisms from microbes to mammals of any given area. This approach is widely used to monitor and measure biodiversity, but largely unexplored in relation to changes to biological communities by contaminants
- Bioremediation uses microorganisms to consume or breakdown environmental pollutants and is an attractive option for remediation due to its low cost, reduction of hazardous waste disposal, and preserve the soil composition and integrity of the site

Objectives

- This study will use eDNA metabarcoding approach on soil samples collected from a Brownfield site in Southern California. This currently abandoned site was previously used as steel mill and more recently as gas station.
- We expect to provide a baseline for the microbial community by depth and in association to the presence of heavy metals and toxic volatile chemical leaks resulted from former activities.
- We expect to provide a profile of microbial communities directly associated with toxic hazardous materials to identify the bacterial mixture for future bioremediation purposes of these sites

Study Site

- The study site is a vacant lot with a size of 2.8 acres with surrounding land use reflecting commercial and industrial facilities.
- The location sits on the Los Angeles Coastal Plains and has a composition of alluvium Holocene sediments.
- The site is on the Central groundwater basin with the Los Angeles River approximately 8 miles east of the property.
- The study site has potential of contamination from hazardous materials from the presence of a past gas station in the form of volatile organic chemical and heavy metals from a steel mill



Figure 1. Study Site

Methodology

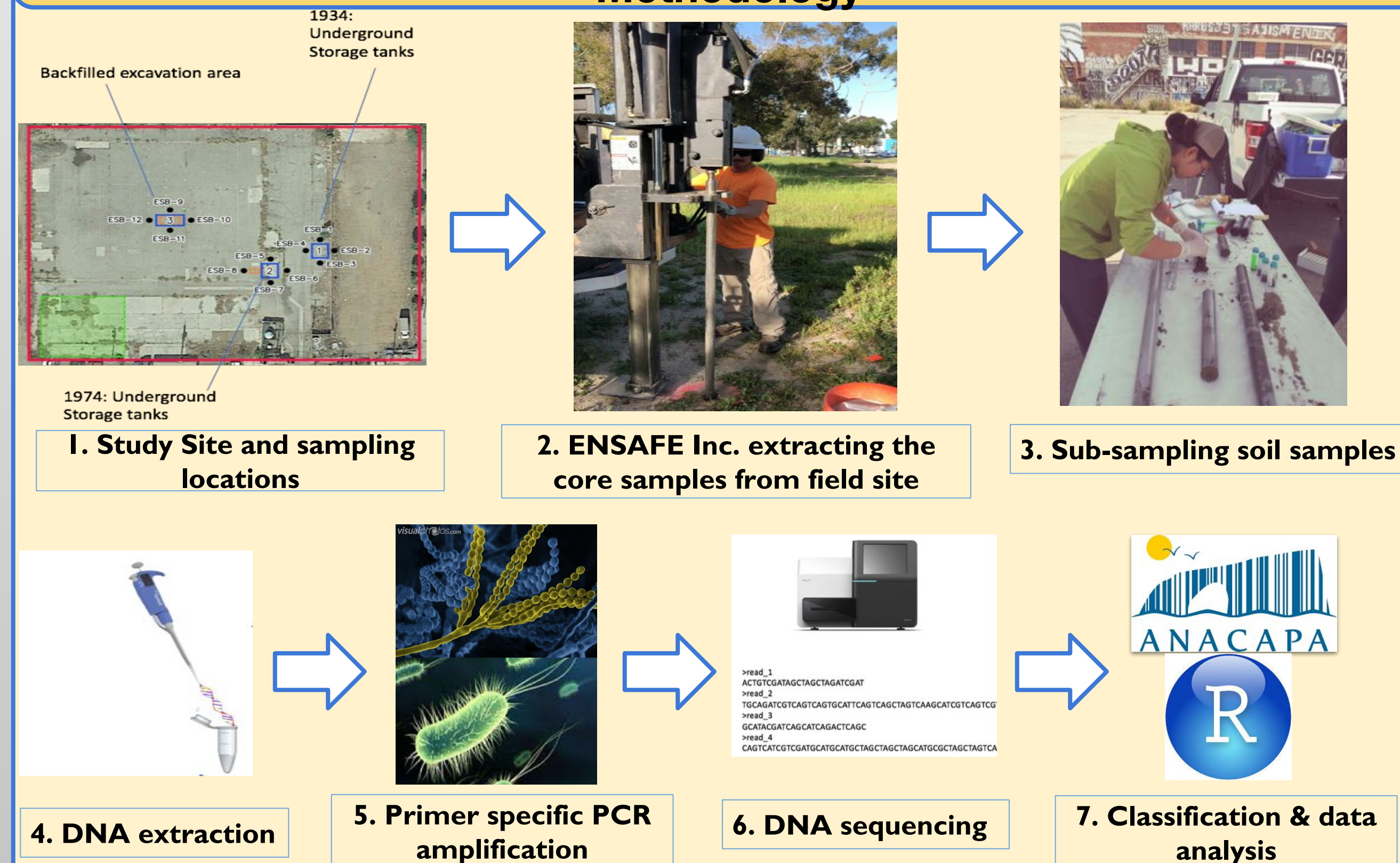


Figure 2. Overview of the methodology

Results

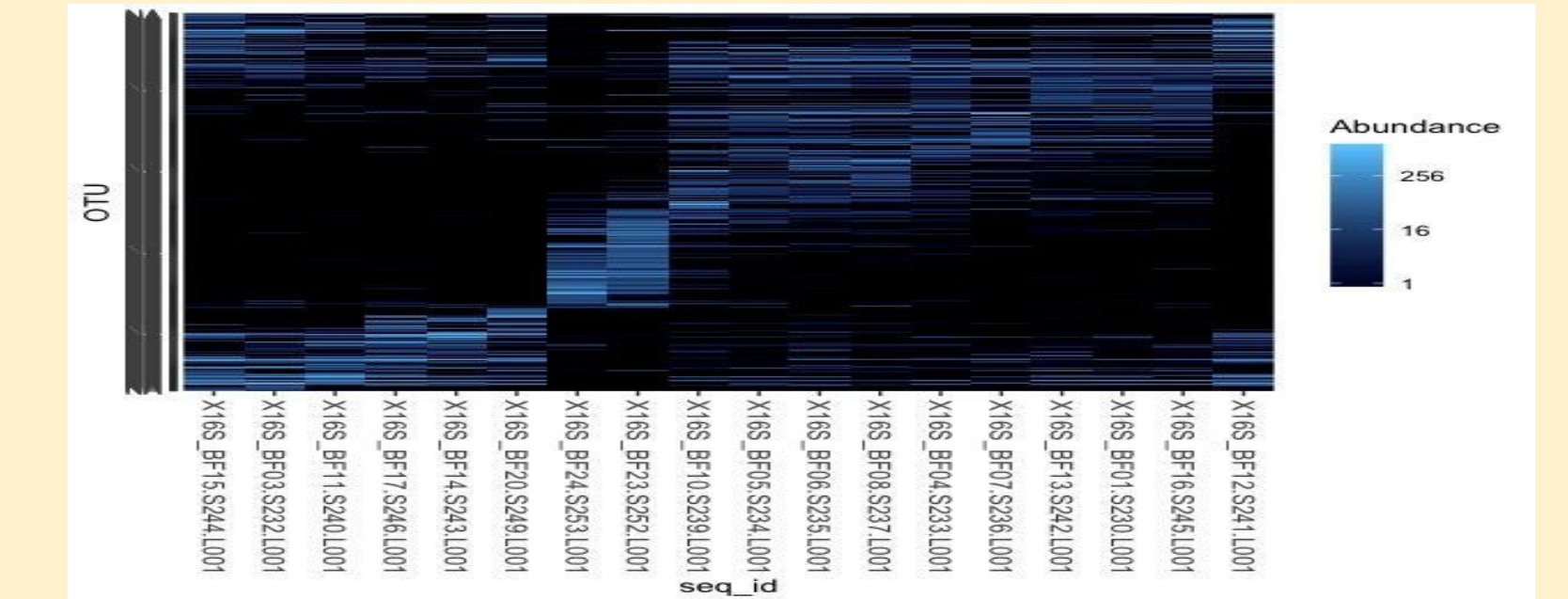


Figure 5. Heatmap depicting abundance of each sequence read for the 16S primer of each sample. Samples 23 and 24 represent control samples.

Discussion

- Actinobacteria and Alphaproteobacteria only found in the controls, both are gram negative bacteria, ubiquitous, and associated with plants
- Anaerolinea has a carbohydrate-based fermentive lifestyle, which may be anaerobically digesting the volatile organic chemicals
- The class of Acidobacteria are abundant in the core soil samples and depth samples. This class of bacteria is prevalent in highly acidic and heavy metal containing soils. Based on the figure 4, they are found below the surface and can be categorized as anaerobic and heterotrophic
- The heatmap analysis demonstrates clear profiles of the biological communities based on shared environmental conditions. One sample had a unique profile, which will be further explored

Results

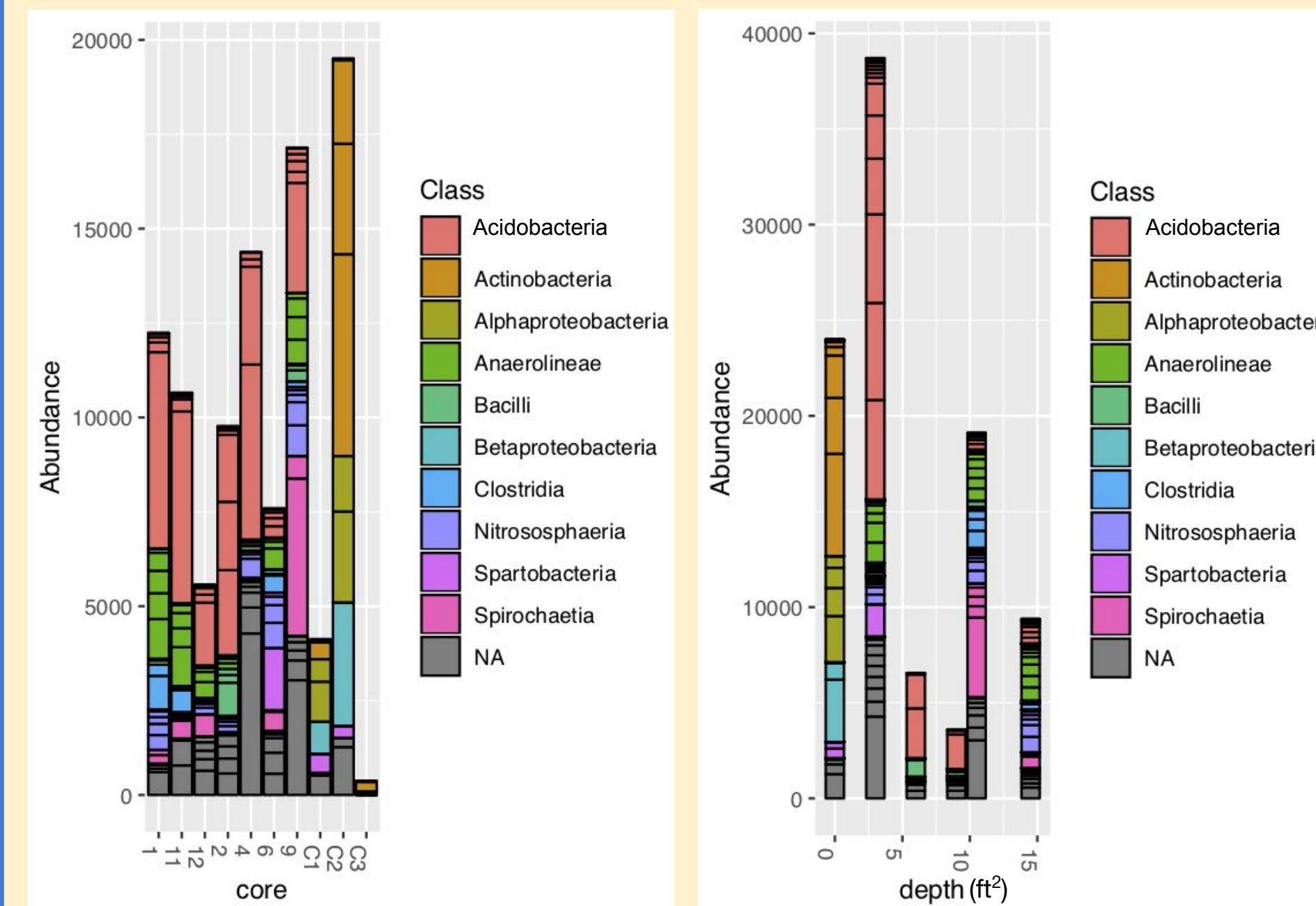


Figure 3 & 4. Class Abundance of organisms for the 16S primer by core position and depth. Samples C1, C2, & C3 represent control samples.

- Altered bacterial composition
- High abundance of Acidobacteria
- Absence of Alphaproteobacteria

Future Direction

- Identify the functional role of the microbial communities for bioremediation application
- Correlate the microbial communities to excessive levels of volatile organic chemicals and heavy metals
- Expand to cover other Brownfield sites across Los Angeles with similar or other toxic substances

Reference

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