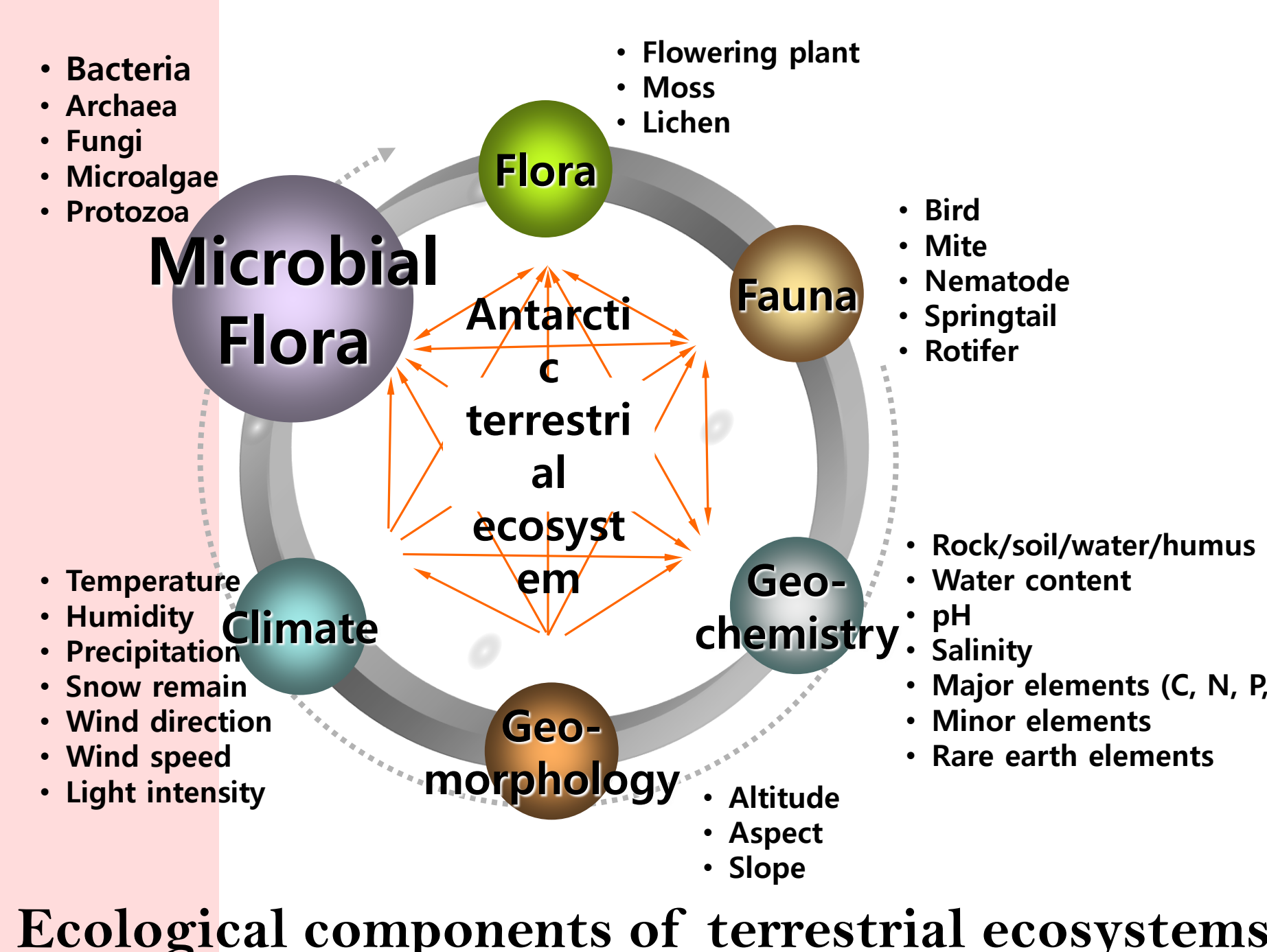


Comprehensive Analysis of Soil Bacterial Community Structure in King George Island, Maritime Antarctica

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Introduction



In order to understand terrestrial ecosystem in Barton Peninsula, we have evolved a multidisciplinary project. There are six main components which sustain terrestrial ecosystem. As biotic factors, we considered microflora, flora and fauna, whereas climate, geomorphology and geochemistry can be considered as abiotic factors. Each component also has several sub-factors. For example, geomorphology has such altitude, aspect and slope. Components are related to each other. Climate can affect the composition of microbial flora, flora, fauna and geochemistry, while climate can be affected by geomorphology.

Over the last few decades, terrestrial environments in Antarctica had been believed as sterilized habitats without any life forms because of the extreme conditions. In recent years, expansions of molecular biological methods to study microbial communities have detected unexpectedly high diversity and complexity of bacteria community in this harsh environment. *Actinobacteria*, *Bacteroidetes*, *Gemmatimonadetes* and *Alphaproteobacteria* were dominant in McMurdo Dry Valleys of Antarctic continent (Lee, *et al.*, 2011). Then, how about maritime Antarctica? Which bacterial phyla are dominant and how similar are bacterial community structures between soil habitats in this region? We conducted a comprehensive analysis of bacterial communities in soil samples from Barton Peninsular in Antarctica. In total 258 soil samples from 51 sites were collected during the period from December 2010 to February 2012. Among these samples, we here present preliminary results with 85 samples in 15 sites.

Study Site and Methods

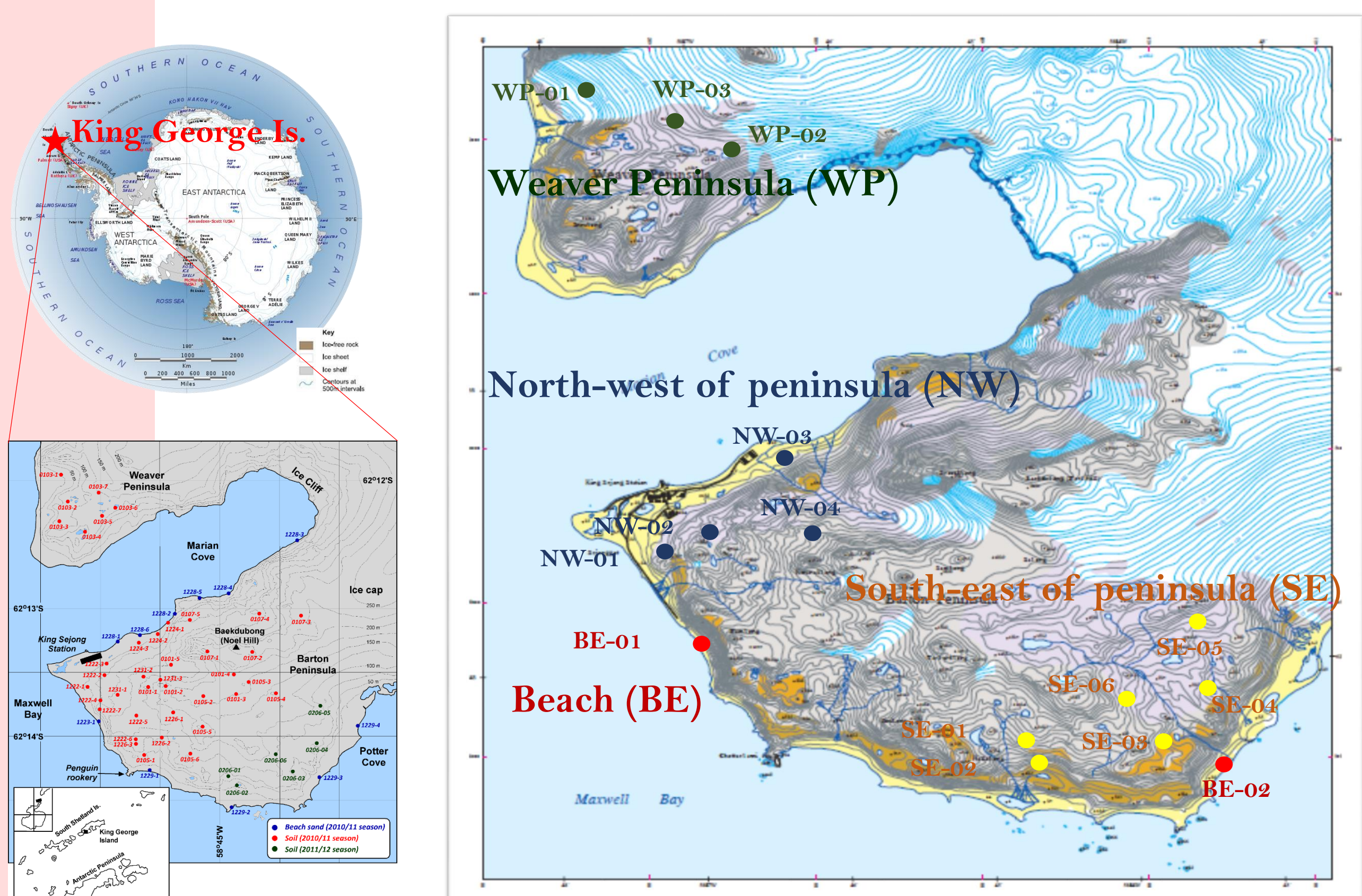
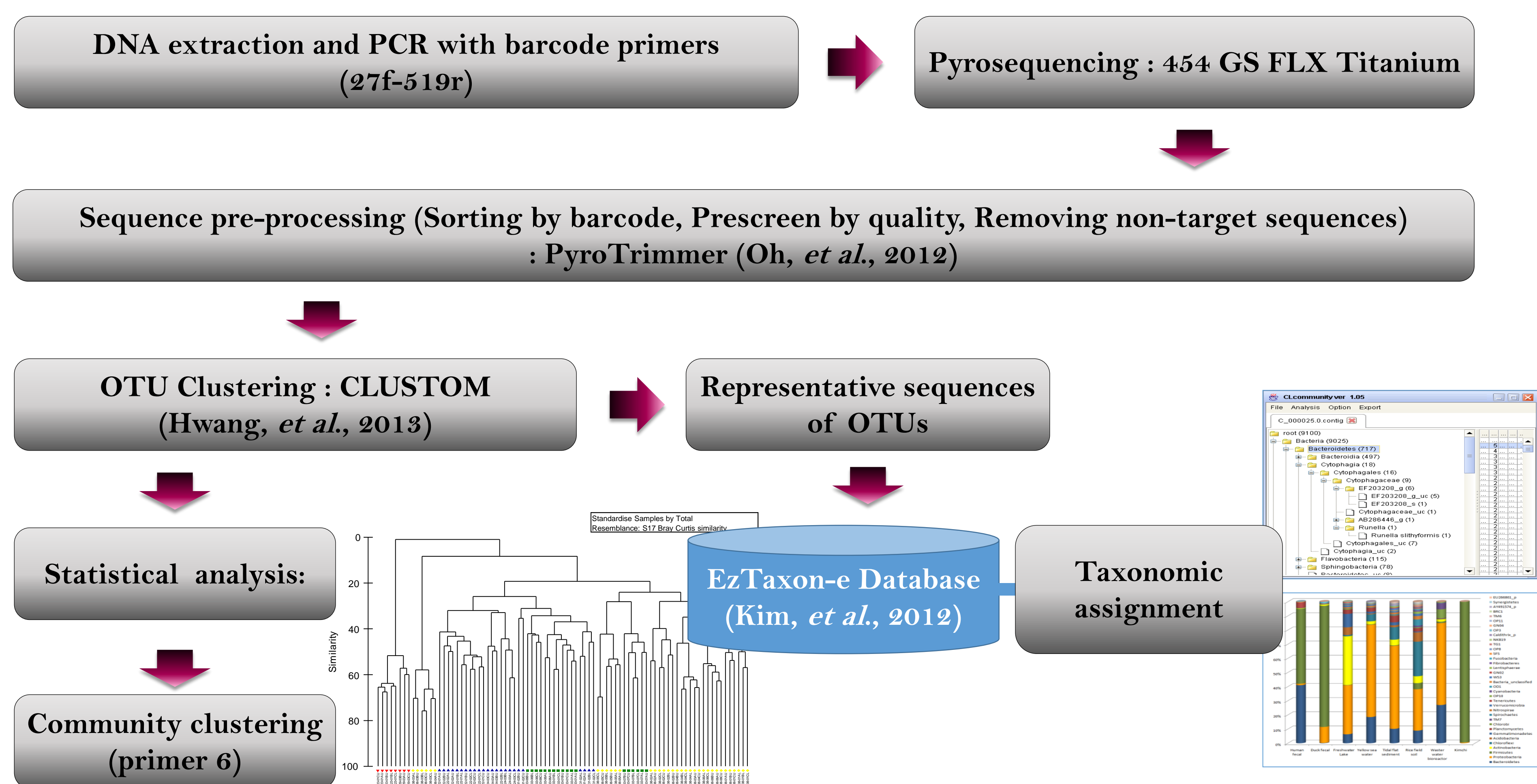


Fig. 1. Sampling sites in Antarctica. Soil samples were collected from the Barton and Weaver Peninsula in King George Island.



Results

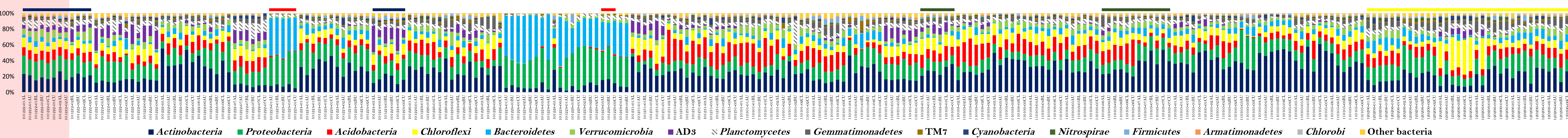


Fig. 2. Bacterial phyla distribution of 258 soil samples in King George island. Phylum-level bacterial community structure largely corresponded to the habitat locality.

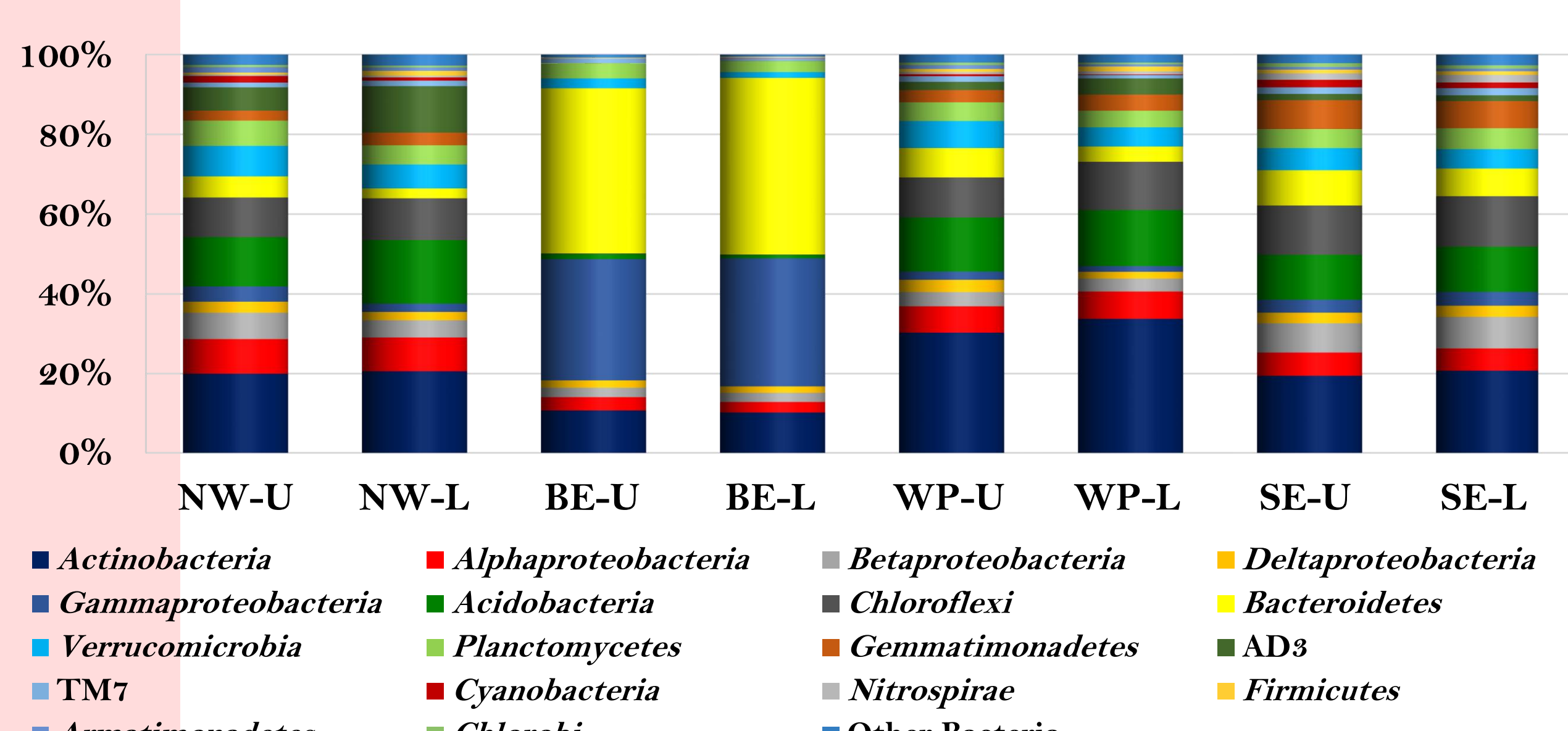


Fig. 3. Bacterial phyla distribution at two soil depth profiles. U, Upper soil layer (top 0~3cm); L, Lower soil layer (3~10cm)

- The most dominant phyla in the area of Barton and Weaver peninsula were *Actinobacteria*, *Proteobacteria*, *Acidobacteria* and *Chloroflexi*.
- There were no significant differences of phyla composition between upper and lower soil layers.

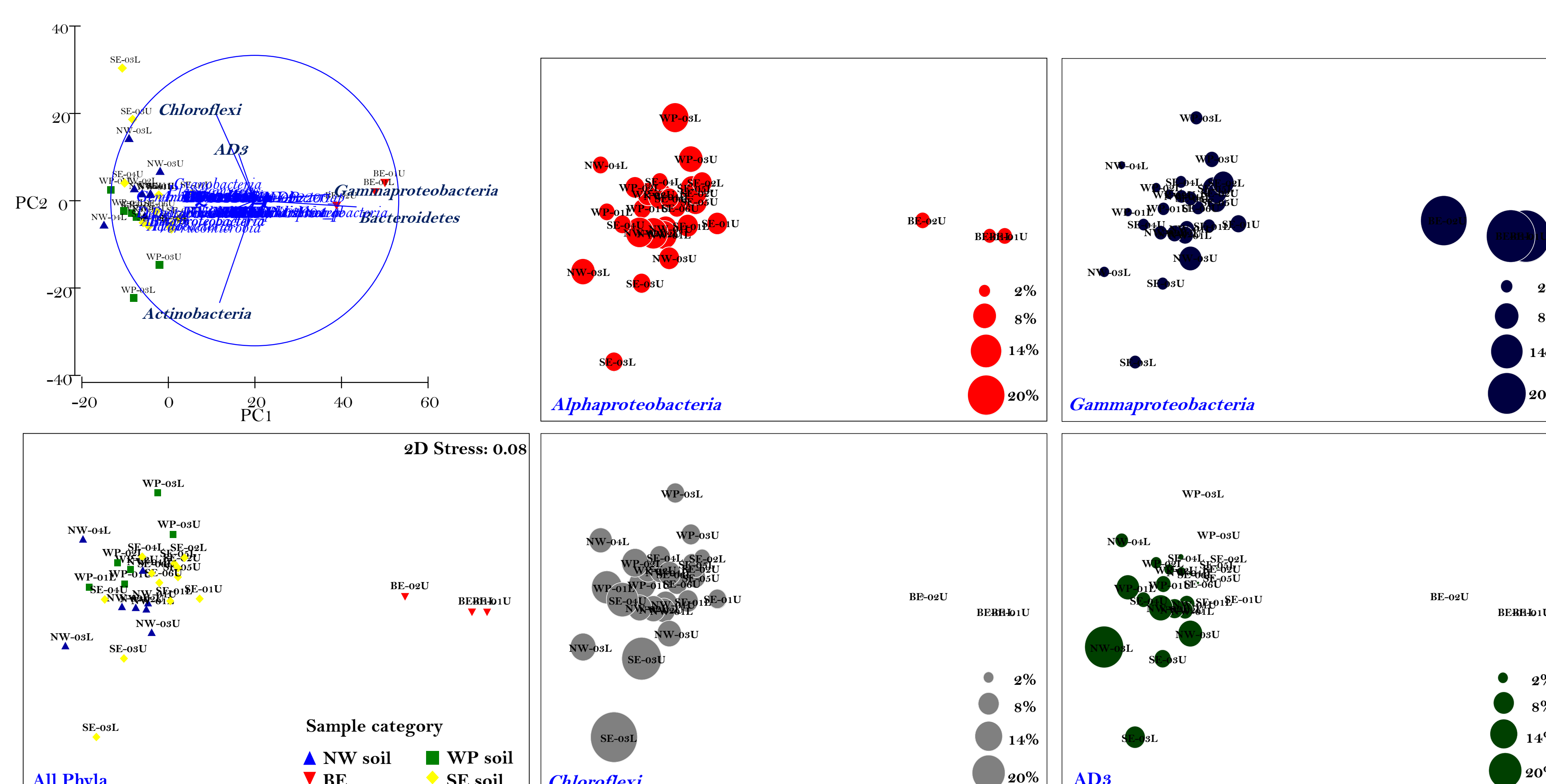


Fig. 5. PCA plot based on investigated relative abundance of bacterial phyla. Phylum-level community structure was mainly explained by three bacterial phyla, *Actinobacteria*, *Chloroflexi* and *Bacteroidetes*. Non-metric multidimensional scaling (NMDS) plots were generated using Bray-Curtis dissimilarity index based on the relative abundance of bacterial phyla in each soil sample. Bubble size represents the relative abundance of the designated bacterial phylum in each sample.

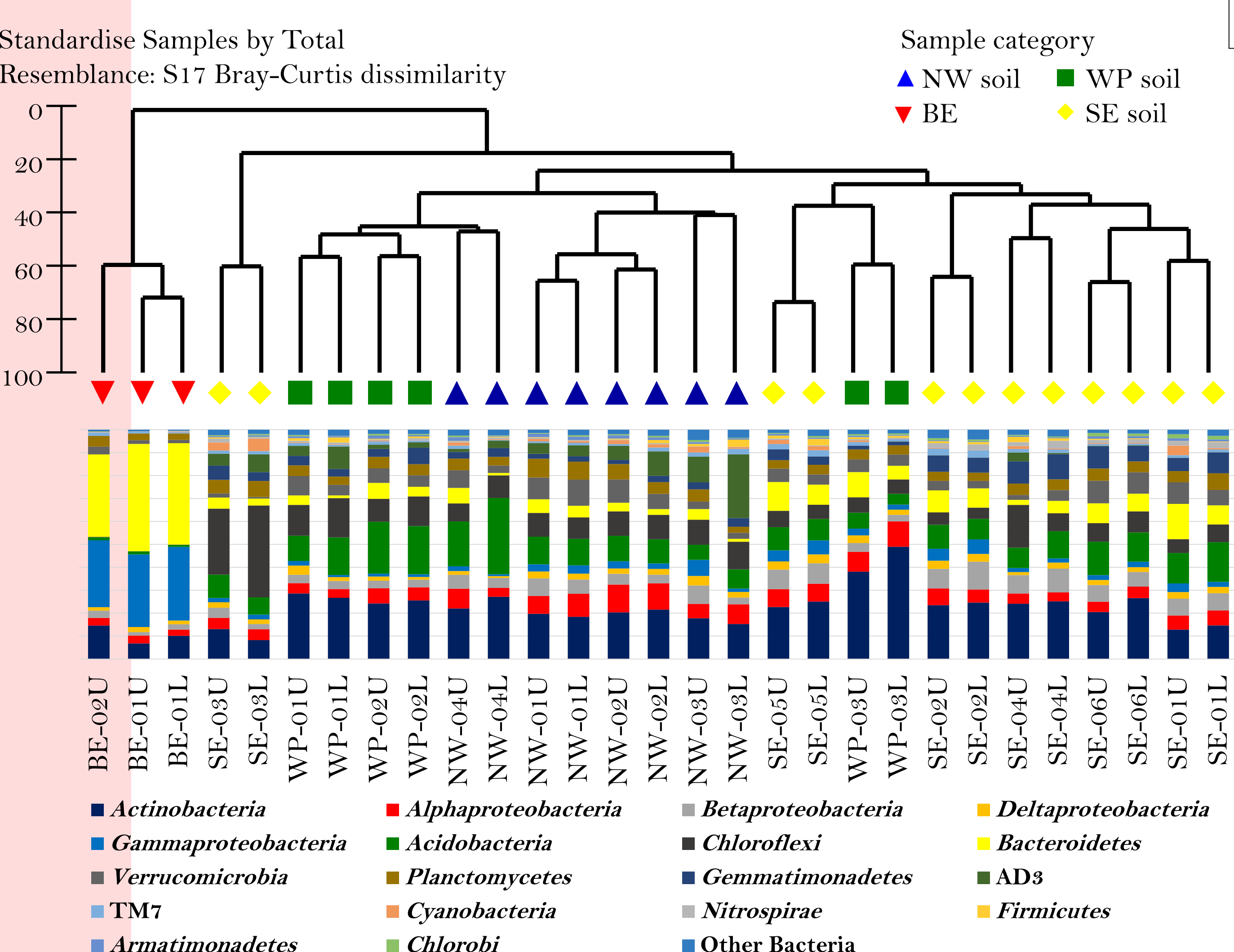


Fig. 4. Pattern of OTU-level community clustering between samples. Phyla composition profile was added at the bottom for comparison. The relative abundance values were averaged among three samples per site. U, Upper layer soil (0~3cm); L, Lower layer soil (3~10cm)

- Soil bacterial community was distinctively clustered by habitat locality.

Conclusions

- Actinobacteria*, *Proteobacteria*, *Acidobacteria* and *Chloroflexi* were dominant in the surface soils of King George Island. Distinct soil bacterial community structure was found in this harsh environment, different from those of other biomes such as tropics and temperate zone.
- Candidate phylum AD3 was abundant in several soil samples, which has not been recognized in previous studies. The bacterial community structures in this locality were habitat-specific. *Bacteroidetes* were more dominant in coastal soil, *Proteobacteria* in upper layer soil and *Actinobacteria* in lower layer soil.
- Highly heterogeneous bacterial communities were observed between both soil depth and habitats in this narrow range of the peninsula (within the range of 2 km).

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