

Preface

In 2007, when I started my PhD, I got motivated to apply ecology theory to understand the functioning of microbial diversity. Though having a background in agriculture, soil and environmental microbiology, I could not understand completely whether and how I can apply ecology theory to the microbial world. Probably because I did not know exactly what is “ecology theory” by itself. Is it something similar to Einstein’s theory of special relativity with well-defined definition and assumptions? No, this was not the case. Later on while going through a diverse microbial and ecological literature, I realized that the definition of ecology theory is much broader and complex than I ever thought about it. Ecology theory realized to me as a broad set of different ecological hypotheses, theories, concepts, principles and understandings—that have been broadly investigated and established in macro-ecology. Keeping in mind the complexity of microbial ecosystems, microbial ecologists used ecology theory to comprehend the patterns of microbial diversity and functioning in the ecosystem. The objective of this small book is to compile and present a basic understanding of ecology theory, and its role in microbiome or microbial community ecology. While it is my “personal bias” that small and brief writing is always beautiful and not boring for the readers. Though not too detailed, I still hope that this book would be reasonably comprehensive in its contents. I hope that it would be useful for undergraduates, graduates, postdoctoral researchers, and professors involved in academic and research.

The book is comprised of six chapters, covering key subject areas. While each chapter is divided into sections, and then sections are divided into topical subsections. The presentation of different areas and subsections might be somewhat arbitrary, and therefore might be criticized very easily by some colleagues favoring to a different order or organization of ideas into different ways. Overall in this book, I preferred to use term “microbiome” most of the cases than using microbe or microbial, since former has been used more frequently in recent work. The Chap. 1 briefly introduces the microbiome diversity, abundance, species concept and microbiome community ecology. Whereas Chap. 2 discusses the theories, patterns and mechanisms of microbiome species diversity and coexistence. But the Chap. 3 describes the ecological processes such as selection, drift, dispersal and mutation, and their role in reshaping the patterns of microbiome diversity and functioning. Chapter 4

briefly describes the microbiome diversity of key habitats, and then suggests the role of global change and trophic downgrading in altering microbial niches, diversity, and in the loss of microbial diversity. Similarly, Chap. 5 briefly describes the role of microbiome in structuring multitrophic interactions. While Chap. 6 discusses the implications of microbiome diversity functioning research in different fields for human well-being in addition to briefly summarizing the key issues confronted to basic and applied microbiome research. Overall, all six chapters attempt to describes briefly different areas with respect to climate and land use changes. The book might be criticized for its broad but very brief contents and less details. This is mainly due to the limited space provided by the publisher, and my limited understanding of this subject. Moreover, this is also because the book is much different from the classical microbial ecology books. Compiling and writing this book turned out to be a much difficult and different from stereotype writing since the field is very new and dynamic. Simply put, that is it what it is, and nobody is perfect. I am also learning the very basics of this field.

In compiling this book, I used a lot of stuff from other researcher's work including but it is not limited to these: ideas, thoughts, text, figures and tables, etc. Although I have tried my best to reuse this stuff with standard scientific acknowledgement manners both in text and in literature cited list. But in some cases, I could not rewrite or change a lot with the fear that it may change the meaning and context of a finding, especially in the text of figures and tables legends. I very much apologize for that in advance. Overall, I acknowledge and dedicate this little work to every individual working in this area of research, and I apologize very much to the colleagues whose work I could not cite and acknowledge in this space limited book.

I greatly acknowledge the comments, thoughts and support from my peers, colleagues, and friends to whom I owe a debt of thanks. Meanwhile, I would greatly appreciate the reviewers of this book whose comments made it much easier for me to develop better contents relevant to different areas of research covered in this book. Finally, I am highly thankful to Janet Slobodien, Editor, Ecology & Evolutionary Biology Section, Springer Science+Business Media, New York, for inviting me to write this book. Meanwhile, I would greatly acknowledge and appreciate the support of Zachary Romano, Editorial Assistant, Life Sciences, Springer Science+Business Media, New York, NY, USA. At the end, I would like to say millions of thanks to my little princess, Hadia and Salihah, my beloved wife Dr. Zahida Hassan Pervaiz. I have no words to express the support and love of my parents towards me, a symbol of hard work and patience for me.

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Fundamentals and Applications

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