

Contents

| | |
|---|-------------|
| Contributors | xi |
| Foreword | xiii |
| Acknowledgments | xv |
| | |
| 1 Microbial Ecology Analysis of Biochar-Augmented Soils: Setting the Scene | 1 |
| T. KOMANG RALEBITSO-SENIOR AND C.H. ORR | |
| Overview | 2 |
| Biochar | 2 |
| Biochar and Its Applications | 5 |
| Biochar as Habitat for Soil Organisms | 16 |
| Soil Biota Response to Biochar | 19 |
| Policy Guidelines and Requirements for Biochar Application | 24 |
| Summary | 31 |
| References | 32 |
| | |
| 2 Feedstock and Production Parameters: Effects on Biochar Properties and Microbial Communities | 41 |
| C. STEINER, A.O. BAYODE AND T. KOMANG RALEBITSO-SENIOR | |
| Biochar Characteristics and Key Determining Parameters | 41 |
| Influence of Biochar on Microbial Communities | 44 |
| Conclusions and Outlook | 51 |
| References | 51 |
| | |
| 3 Biochar Effects on Ecosystems: Insights From Lipid-Based Analysis | 55 |
| E.-L. NG AND T.R. CAVAGNARO | |
| Background | 56 |
| Extracting Lipids and Production of Fatty Acid Methyl Esters | 58 |
| Making Sense of PLFA: Analytical Approach and Interpretation of PLFA Data | 59 |
| Compositional and Structural Insights From PLFA | 64 |
| Biochar as Habitat | 68 |
| Linking Who to What: Functional Insights From PLFA | 69 |

| | |
|---|-----|
| Misuse of PLFA | 72 |
| Conclusions | 73 |
| Acknowledgments | 74 |
| References | 74 |
| | |
| DGGE-Profiling of Culturable Biochar-Enriched Microbial Communities | 78 |
| T. KOMANG RALEBITSO-SENIOR, C.J. ENNIS, C.H. ORR, P. BARAKOTI AND J. PICKERING | |
| Introduction | 79 |
| The Case Study | 83 |
| Chapter Conclusions and Future Recommendations | 95 |
| Acknowledgments | 102 |
| References | 102 |
| | |
| 5. Next-Generation Sequencing to Elucidate Biochar-Effected Microbial Community Dynamics | 109 |
| E.S. CANNAVAN, E.M. NAKAMURA, M.G. GERMANO, L.F. DE SOUZA AND S.M. TSAI | |
| Introduction | 110 |
| Anthropogenic Biochar | 112 |
| Biochar and Soil Properties | 113 |
| The Microbial Diversity in Biochar | 115 |
| Biochar and the Amazonian Dark Earth: A Case Study | 115 |
| Future Research | 126 |
| Acknowledgments | 127 |
| References | 127 |
| | |
| 6. Examining Biochar Impacts on Soil Abiotic and Biotic Processes and Exploring the Potential for Pyrosequencing Analysis | 133 |
| R. CHINTALA, S. SUBRAMANIAN, A.-M. FORTUNA AND T.E. SCHUMACHER | |
| Introduction | 134 |
| Abiotic Processes | 136 |
| Biotic Processes | 147 |
| Metagenomic Sequencing Technologies | 152 |
| Conclusions | 157 |
| References | 157 |
| | |
| 7. Elucidating the Impacts of Biochar Applications on Nitrogen Cycling Microbial Communities | 163 |
| N. HAGEMANN, J. HARTER AND S. BEHRENS | |
| Introduction | 164 |
| The Microbial Nitrogen Cycle | 165 |

| | |
|--|-----|
| Biochar's Physicochemical Properties Affecting Soil Microbial Nitrogen Transformations | 171 |
| Biochar Effects on Soil Microbial Nitrogen Cycling | 177 |
| Knowledge Gaps and Future Research | 185 |
| Global Impact of Biochar on Soil Nitrogen Cycling | 187 |
| Acknowledgments | 189 |
| References | 189 |
| | |
| 8. Microbial Ecology of the Rhizosphere and Its Response to Biochar Augmentation | 199 |
| C.H. ORR, T. KOMANG RALEBITSO-SENIOR AND S. PRIOR | |
| Introduction | 200 |
| An Illustrative Study | 208 |
| Conclusion | 216 |
| Acknowledgments | 217 |
| References | 217 |
| | |
| 9. Potential Application of Biochar for Bioremediation of Contaminated Systems | 221 |
| H. LYU, Y. GONG, R. GURAV AND J. TANG | |
| Introduction | 222 |
| Environmental Application of Biochar in Heavy Metal-Contaminated Systems | 222 |
| Environmental Application of Biochar in Systems Impacted by Organic Pollutants | 229 |
| Environmental Application of Biochar to Groundwater Systems | 235 |
| Recommendations for Further Research | 240 |
| Acknowledgments | 240 |
| References | 240 |
| | |
| 10. Interactions of Biochar and Biological Degradation of Aromatic Hydrocarbons in Contaminated Soil | 247 |
| G. SOJA | |
| Introduction | 247 |
| PAH Degradation | 249 |
| Biochar and Atrazine Interactions | 257 |
| Conclusions, Outlook, and Future Research Needs | 259 |
| References | 261 |
| | |
| 11. A Critical Analysis of Meso- and Macrofauna Effects Following Biochar Supplementation | 268 |
| X. DOMENE | |
| Role of Fauna in Soil Ecosystem Structure and Function | 269 |
| Fauna Effects on Biochar: Bioturbation and Persistence | 270 |

| | |
|--|------------|
| Biochar Effects on Soil Fauna | 273 |
| Interactions Between Biochar and Fauna | 282 |
| References | 286 |
| | |
| Summation of the Microbial Ecology of Biochar Application | 293 |
| C.H. ORR AND T. KOMANG RALEBITSO-SENIOR | |
| | |
| Book Rationale | 293 |
| Methodological State of the Art | 296 |
| Book/Knowledge Paucities and Recommendations for Future Work | 302 |
| Summary | 307 |
| References | 308 |
| | |
| Index | 313 |