



Root Ecology

L. Brussaard, M.J. Kooistra



Root Ecology:

Root Ecology Hans de Kroon, Eric J.W. Visser, 2003-05-21 In the course of evolution a great variety of root systems have learned to overcome the many physical biochemical and biological problems brought about by soil This development has made them a fascinating object of scientific study This volume gives an overview of how roots have adapted to the soil environment and which roles they play in the soil ecosystem The text describes the form and function of roots their temporal and spatial distribution and their turnover rate in various ecosystems Subsequently a physiological background is provided for basic functions such as carbon acquisition water and solute movement and for their responses to three major abiotic stresses i e hard soil structure drought and flooding The volume concludes with the interactions of roots with other organisms of the complex soil ecosystem including symbiosis competition and the function of roots as a food source

Methods of Studying Root Systems W. Böhm, 2012-12-06 Root research under natural field conditions is still a step child of science The reason for this is primarily methodological The known methods are tedious time consuming and the accuracy of their results is often not very great Many research workers have been discouraged by doing such root studies The need for more information on the development and distribution of plant roots in different soils under various ecological conditions is however obvious in many ecological disciplines Especially the applied botanical sciences such as agriculture horticulture and forestry are interested in obtaining more data on plant roots in the soil This book will give a survey of existing methods in ecological root research Primarily field methods are presented techniques for pot experiments are described only so far as they are important for solving ecological problems Laboratory methods for studying root physiology are not covered in this book Scientific publications on roots are scattered in many different journals published all over the world By working through the international root literature I found that about ten thousand papers on root ecology have been published at the present This is not very much compared with the immense literature on the aboveground parts of the plants but is however too much to cite in this book

Plant Functional Ecology Nianpeng He, Guirui Yu, Congcong Liu, Ying Li, Ruili Wang, 2025-07-01 This book provides a comprehensive exploration of plant functional traits and their critical role in understanding and predicting ecosystem functions in response to environmental changes By bridging the gap between traditional ecological research and emerging macro ecological technologies this book offers an in depth understanding of how functional traits at various levels from organs to entire ecosystems can be utilized to address complex ecological challenges including global change The chapters cover a wide range of topics essential to the field of ecology including the development and application of plant functional traits the scaling of traits from individual plants to communities and the integration of these traits into advanced models and remote sensing technologies Novel frameworks such as plant community traits ecosystem traits ESTs and plant trait networks PTNs are discussed providing new ways to link species level traits with ecosystem processes These concepts are pivotal in expanding the application of trait based ecology allowing for more

accurate predictions of ecosystem productivity community assembly and biodiversity patterns on a regional and global scale The book also addresses the challenge of linking leaf and root traits to ecosystem functions offering insights into how these traits can be scaled up and used to understand the adaptation strategies of plants in complex environments Targeted at undergraduate and graduate students and researchers in ecology this book is ideal for those seeking both fundamental and advanced knowledge of trait based research in ecology Offering valuable insights and practical frameworks that are essential for tackling the ecological challenges the book is a must read for anyone interested in the integration of macroecology geography and remote sensing to solve current regional ecological problems and global change

Root functional traits: From fine root to community-level variation Iván Prieto, Patompong Johns Saengwilai, Ivika Ostonen, Kira A. Borden, Enrique García De La Riva, 2023-03-20

Root Ecology Hans de Kroon, Eric J. W. Visser, 2014-01-15

Ecophysiology of root systems-environment interaction Boris Rewald, Omer Falik, Douglas Godbold, Shimon Rachmilevitch, 2014-09-03

There is a scarcity of detailed information regarding the ecophysiology of root systems and the way root system functioning is affected by both internal and external factors Furthermore global climate change is expected to increase the intensity of climate extremes such as severe drought heat waves and periods of heavy rainfall in addition other stresses such as salinization of soils are increasing world wide Recently an increasing awareness has developed that understanding plant traits will play a major role in breeding of future crop plants For example there is increasing evidence that the traits of root systems are defined by the properties of individual roots However further knowledge on the functional importance of root segments and the molecular physiological mechanisms underlying root system functioning and persistence is needed and would specifically allow modifying crop root system functionality and efficiency in the future Another major gap in knowledge is localized at the root soil interface and in regard to the potential adaptive plasticity of root rhizosphere interactions under abiotic stress and or competition It is currently unknown whether adaptations in microbe communities occur for example due to modified exudation rates and what are the subsequent influences on nutrient mobilization and uptake Furthermore uncovering the mechanisms by which roots perceive neighboring roots may not only contribute to our understanding of plant developmental strategies but also has important implications on the study of competitive interactions in natural communities and in optimizing plant performance and resource use in agricultural and silvicultural systems In this Research Topic we aimed to provide an on line open access snapshot of the current state of the art of the field of root ecology and physiology with special focus on the translation of root structure to function and how root systems are influenced by interplay with internal and external factors such as abiotic stress microbes and plant plant interaction We welcomed original research papers but reviews of specific topics articles formulating opinions or describing cutting edge methods were also gladly accepted

Plant Roots Peter J. Gregory, 2025-11-10 An updated overview of plant root systems covering their development growth interactions with soil breeding and management Plant Roots draws together information from plant and soil literature to

illustrate how roots interact with soil both to modify it and to obtain from it the resources required for the whole plant to grow. Emphasis is placed on whole plants and root systems with appropriate references to the growing body of literature on plant molecular and cellular levels. This newly revised and updated Second Edition maintains its balance between introducing the founding ideas and science underlying the topic while covering the most recent updates underpinned by new scientific methods and understanding. The author reviews recent advances in genomics, phenomics, other omics technologies, computer modelling and the study of model plants such as *Arabidopsis thaliana* and rice which have led to major advances in understanding how roots grow and function. New crop varieties contributing to increased crop production especially in nutrient poor and/or water limited soils are described together with new ways of managing root systems to improve crop performance and efficiency of resource use. Sample topics discussed in *Plant Roots* include: The anatomy and growth of primary roots; The development and properties of the rhizosphere; Heterogeneity of structure, nutrient availability and microbial communities experienced in field soils; Differences in anatomy and morphology between different types/classes of root and their consequences for activity as absorbers of water and nutrients; How crops/forests/natural plant communities and the resources supporting them might be managed more effectively. *Plant Roots* is an essential source of reference aimed at students and professionals who already have some background knowledge of soils and plants and are seeking to understand cutting edge updates in the field.

Root Methods A.L. Smit, A.G. Bengough, C. Engels, M. van Noordwijk, S. Pellerin, S.C. van de Geijn, 2013-03-09. Why a New Handbook on Root Methods? Uptake of water and nutrients is a key process in agricultural and natural ecosystems. Plant roots play a vital role in the supply of resources for growth and yet we have a relatively poor understanding of how they function in the natural soil environment. Dr Böhmer began the Preface of his standard text on root research methods Böhmer 1979 with the comment: Root research under natural field conditions is a stepchild of science. The reason for this is primarily methodological. The known methods are tedious, time consuming and the accuracy of their results is of ten not very great. Although improvements have been made recently for some methods working on roots is still tedious and time consuming. Compared to some other disciplines a root researcher requires a considerable budget for his or her work. It is for this reason that in root research careful planning, the choice of appropriate methods and also a clear idea of which root characteristic should be observed in relation to the goal of the research question are fundamental. Consequently it is recommended to make use of root experience developed elsewhere as much as possible.

Plant Roots Yoav Waisel, Amram Eshel, Tom Beeckman, Uzi Kafkafi, 2002-03-29. The third edition of a standard resource, this book offers a state-of-the-art, multi-disciplinary presentation of plant roots. It examines structure and development, assemblage of root systems, metabolism and growth, stressful environments and interactions at the rhizosphere. Reflecting the explosion of advances and emerging technologies in the field, the book presents developments in the study of root origin, composition, formation and behavior for the production of novel pharmaceutical and medicinal compounds, agrochemicals,

dyes flavors and pesticides It details breakthroughs in genetics molecular biology growth substance physiology biotechnology and biomechanics **Structure and Function of Roots** F. Baluska, Milada Ciamporová, Otília Gasparíková, Peter W.

Barlow, 2013-11-11 In 1971 the late Dr J Kolek of the Institute of Botany Bratislava organized the first International Symposium devoted exclusively to plant roots At that time perhaps only a few of the participants gathered together in Tatranska Lomnica sensed that a new era of root meetings was beginning Nevertheless it is now clear that Dr Kolek's action undertaken with his characteristic enormous enthusiasm was rather pioneering for it started a series of similar meetings Moreover what was rather exceptional at the time was the fact that the meeting was devoted to the functioning of just a single organ the root One possible reason for the unexpected success of the original perhaps naive idea of a Root Symposium might lie with the fact that plant roots have always been extremely popular as experimental material for cytologists biochemists and physiologists wishing to probe processes as diverse as cell division and solute transport Of course the connection of roots with the rest of the plant is not forgotten either This wide variety of disciplines is now coupled with the development of increasingly sophisticated experimental techniques to study some of these old problems These factors undoubtedly contribute to the necessity of continuing the tradition of the root symposia The common theme of root function gives in addition a certain unity to all these diverse activities *Root Demographics and Their Efficiencies in Sustainable*

Agriculture, Grasslands and Forest Ecosystems James E. Box Jr., 2012-12-06 The International Society of Root Research sponsored the Symposium Root Demographics and Their Efficiencies in Sustainable Agriculture Grasslands and Forest Ecosystems July 14-18 1996 at the Madren Conference Center Clemson University Clemson South Carolina USA The conference was a continuation of a series of international symposia on root research held every three to four years Symposia have also been held twice in Vienna Austria and once in Uppsala Sweden and Almaty Kazakhstan prior to the meeting at Clemson University The sponsoring society has made a particular effort in these symposia to include root scientists from the former Soviet Union because of the importance of exchanging information on a worldwide basis This symposium continued and promoted that effort by providing travel grants to several scientists from that region however funds for that purpose were limited Therefore in compiling these proceedings a number of papers from scientists from the former Soviet Union and former Warsaw Pact countries have been included even though the scientists were not actually present for the Symposium Plant Roots and Their Environment B.L. McMichael, H. Persson, 2012-12-02 Scientists within

a wide field ranging from applied forestry and agriculture to physiology ecology and the environmental sciences are today more than ever involved in root and mycorrhizal research New problem oriented research fields have arisen such as the effects of fertilizers and pesticides forest management and regeneration etc At a time when root research is expanding into different areas it is much more difficult for the root scientist to penetrate all the new information appearing in literature The contributors of this volume are leading scientists from different fields of root research The ISRR symposium in Uppsala

clearly demonstrated that there are new techniques in progress in particular with regards to video recording of plant root systems and digital image processing The main objectives of the symposium were i to provide a forum for communication between scientists from different disciplines working with root research problems ii to contribute to an expansion of root studies into new areas iii to use current estimates of root turnover for charting the upper and lower limit of below ground production and iv to spread knowledge of new findings and techniques of the importance of root research This book is aimed at serving as a vehicle for improving the coherence of root research for harmonizing methods and establishing overall objectives and gaps in the knowledge of rhizosphere dynamics

A Starting Guide to Root Ecology: Strengthening Ecological Concepts and Standardising Root Classification, Sampling, Processing and Trait Measurements

Grégoire T. Freschet, Michael Scherer-Lorenzen, M. Luke McCormack, 2021 Abstract In the context of a recent massive increase in research on plant root functions and their impact on the environment root ecologists currently face many important challenges to keep on generating cutting edge meaningful and integrated knowledge Consideration of the below ground components in plant and ecosystem studies has been consistently called for in recent decades but methodology is disparate and sometimes inappropriate This handbook based on the collective effort of a large team of experts will improve trait comparisons across studies and integration of information across databases by providing standardised methods and controlled vocabularies It is meant to be used not only as starting point by students and scientists who desire working on below ground ecosystems but also by experts for consolidating and broadening their views on multiple aspects of root ecology Beyond the classical compilation of measurement protocols we have synthesised recommendations from the literature to provide key background knowledge useful for 1 defining below ground plant entities and giving keys for their meaningful dissection classification and naming beyond the classical fine root vs coarse root approach 2 considering the specificity of root research to produce sound laboratory and field data 3 describing typical but overlooked steps for studying roots e g root handling cleaning and storage and 4 gathering metadata necessary for the interpretation of results and their reuse Most importantly all root traits have been introduced with some degree of ecological context that will be a foundation for understanding their ecological meaning their typical use and uncertainties and some methodological and conceptual perspectives for future research Considering all of this we urge readers not to solely extract protocol recommendations for trait measurements from this work but to take a moment to read and reflect on the extensive information contained in this broader guide to root ecology including sections I VII and the many introductions to each section and root trait description Finally it is critical to understand that a major aim of this guide is to help break down barriers between the many subdisciplines of root ecology and ecophysiology broaden researchers views on the multiple aspects of root study and create favourable conditions for the inception of comprehensive experiments on the role of roots in plant and ecosystem functioning

Plant Strategies Daniel C. Laughlin, 2023 The goal of this accessible book is to articulate a coherent framework that

unifies life history theory with comparative functional ecology to advance prediction in plant ecology Predicting how species respond to global change is perhaps the most important challenge of our time

Behaviour and Physiology of Root Herbivores, 2013-11-19 Drawing on expertise from around the world this volume identifies our current state of knowledge about the behavior and physiology of root herbivores In particular this work describes prevailing concepts and theories based on historical and current literature and identifies what new technologies and approaches are available to researchers in the field Chapters address how root herbivore behavior and physiology is affected by the biotic and abiotic soil environment cover case studies of globally significant pests and discuss advances in molecular techniques Covering all aspects of behavioral and physiological responses of root herbivores to their environment this will be valuable reading for researchers and professionals in agricultural entomology plant science ecology and soil science Key topics include Molecular approach to root herbivores Phylloxera Plant metabolites Soil climate Behavioral ecology wireworms

Modulation of Growth and Development of Tree Roots in Forest Ecosystems Donato Chiatante, Kasten Dumroese, Douglas Godbold, Takayoshi Koike, Antonio Montagnoli, Boris Rewald, 2022-03-11

Deep Root Reach Yves Earhart, AI, 2025-01-12 Deep Root Reach unveils the fascinating underground world of plant root systems revealing their crucial role in sustaining life on Earth through complex mechanisms of resource acquisition and environmental adaptation This comprehensive exploration challenges the traditional view of roots as simple structures presenting compelling evidence of their sophisticated decision making abilities and intricate relationships with soil ecosystems The book progresses systematically from root anatomy to advanced concepts like hydraulic lift processes and mycorrhizal partnerships integrating historical observations with cutting edge research Through detailed analysis of electron microscopy data and long term field studies readers discover remarkable findings about root fungal relationships and underground communication networks Particularly intriguing are the revelations about electric signaling between root systems and the active role of root exudates in shaping soil communities Written for both scientists and advanced students this work bridges theoretical understanding with practical applications in sustainable agriculture and ecosystem management The interdisciplinary approach connects plant biology with soil science and climate research offering valuable insights for addressing contemporary challenges in food security and environmental preservation By examining root systems across diverse ecosystems from rainforests to tundra the book provides a comprehensive understanding of how these hidden networks contribute to ecosystem resilience and adaptation to changing environments

Application of Physiology in Wheat Breeding M. P. Reynolds, 2001 *Proceedings of the Second International Scientific Meeting Phaseolus Beans Advanced Biotechnology Research Network BARN* ,

Soil Structure/Soil Biota Interrelationships L. Brussaard, M.J. Kooistra, 2013-10-22 Some pioneers in soil research such as M ller and Kubi na were as much biologists as they were soil scientists and the legendary biologist Charles Darwin was foresighted in recognizing the earthworms as instrumental in reworking the soil thereby forming what he called vegetable mould Still soil science has

largely been the realm of physicists and chemists over the past decades Whatever the reason this picture is rapidly changing Until recently research on the transport and transformation of elements in soil was often concerned with either soil biota plant relationships or with soil structure plant relationships if the biota were considered at all but very few studies explicitly took the interrelationships between soil structure and soil biota into account The conference on Soil Structure Soil Biota Interrelationships held at Wageningen The Netherlands 24 28 November 1991 was meant to bridge that gap focussing on methods of research organized in three levels features processes and effects The proceedings of the conference are testimony of the need to intertwine the biological morphological physical and chemical disciplines in soil research to understand better and forecast soil properties and processes as related to land use for agricultural and other purposes This book should be of particular interest to soil scientists and ecologists who feel the need for a cross disciplinary approach in soils research It should also be a rich source of teaching material for courses in soil science and soil ecology at graduate level and above with ample reference to studies on land use as related to agriculture and the environment

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