



Bryophyte vegetation of forests in relationship to forest management types

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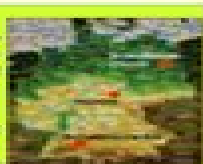


BIODIVERSITY EXPLORATORIES

Introduction:

Three research sites were established for large-scale and long-term functional biodiversity research. These Exploratories are situated in geographically different regions of Germany (see map).

The main objectives of this project are to:
- compare bryophyte diversities of different forest management types on landscape scale
- analyze the main factors promoting high bryophyte diversity in forests



Methods

- bryophyte vegetation relevés on 998 plots (size: 400 m²)
- species were recorded according to their stratum: corticolous (epiphytic and on tree bark), lignicolous (on dead wood), terricolous (on ground) and saxicolous (on rocks)
- coverage estimation of the bare soil, bedrock and litter
- forest inventory recorded: forest type, management type, tree data (species, height, BHD), forest structure and deadwood volume and their decay stage and type.

Results

1. Species numbers

Differences concerning species composition existed between the Exploratories regarding total species number (Tab. 1).

Forests of the Swabian Alb showed the highest bryophyte diversity (Fig. 1), due to high numbers of corticolous and saxicolous species. We counted significant higher species numbers in coniferous plantations than in deciduous forests for all plots in the Hainich and Schorfheide-Exploratory, but not on sites of the Swabian Alb.

Tab. 1: Total species number of Exploratories and number of species that were found only in the Exploratory

Exploratory	Species
Swabian Alb	140
Hainich	140
Schorfheide	140



Developmental stage of age class forests revealed an effect on bryophyte diversity only in the Alb-Exploratory (Fig. 2). Young and old timber stands showed higher species numbers than thickets, pole wood and bare land, but we observed in uneven aged forests (mainly unmanaged) the highest species densities.

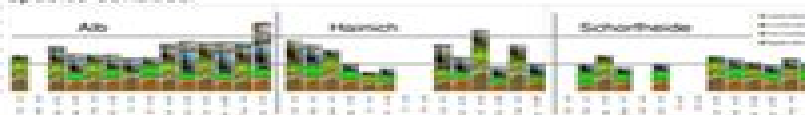


Fig. 2: Bryophyte species density per plot in coniferous (C) and deciduous (D) forests for three forest age classes (pole wood, pole wood, pole wood) in the Alb-Exploratory (C: young timber, D: old timber, C: uneven aged)

2. Qualitative bryophyte vegetation analyses

The species compositions in the Exploratories differed in ecological requirements (Fig. 3, 4). So the most hygrophilous and basophilic communities grew in the Swabian Alb, whereas the communities of the Schorfheide were dominated by acidophilic species.



Fig. 3: Mean indicator values for humidity for all plots of each Exploratory



Fig. 4: Mean indicator values for reaction for all coniferous (C) and deciduous (D) forest plots of each Exploratory

Factors promoting bryophyte diversity:



Corticolous species

Mean breast height diameter (BHD) of several tree species was often positively correlated with species numbers of corticolous bryophytes (Tab. 2). Moreover correlations were also positive with highest BHD, mean tree height and number of individuals of several tree species.

Tab. 2: Bivariate tests of interactions between mean BHD of tree species and corticolous bryophyte diversity (n = 140 significant positive, n = 140 significant negative) in each Exploratory

Tree species	n	n
Alb	140	140
Hainich	140	140
Schorfheide	140	140
Alb	140	140
Hainich	140	140
Schorfheide	140	140
Alb	140	140
Hainich	140	140
Schorfheide	140	140
Alb	140	140
Hainich	140	140
Schorfheide	140	140



Lignicolous species

We could detect decay stages of dead wood and their type as factors, that benefit high diversities of lignicolous species. The most important was dead wood originating from coniferous trees (Tab. 3).

Tab. 3: Bivariate tests of interactions between types of deadwood (coniferous and deciduous) and lignicolous sp. (n = 140 significant positive, n = 140 significant negative) in each Exploratory

Deadwood type	n	n
Alb	140	140
Hainich	140	140
Schorfheide	140	140
Alb	140	140
Hainich	140	140
Schorfheide	140	140
Alb	140	140
Hainich	140	140
Schorfheide	140	140
Alb	140	140
Hainich	140	140
Schorfheide	140	140



Terricolous species

Soil disturbances, caused by human activities or windbreak had positive influence on species densities in deciduous as well as in coniferous forests (Fig. 5). Moreover species numbers were negatively correlated to litter cover [%] and positively to bare soil cover [%] and bryophyte cover [%].



Fig. 5: Species numbers of terricolous bryophytes in coniferous (C) and deciduous (D) forests with and without human or natural disturbances



Saxicolous species

Diversity of saxicolous species is significant influenced by abundance of rocks (C).

Discussion

The observed differences between the Exploratories depend on differences in landscape characteristics e.g. precipitation, altitude, pollution, soil and bedrock attributes.

But the impact of forest management on bryophyte diversity is also present. Plantations of coniferous trees have the most evident and promoting effect of forest management on bryophyte diversity because these forests are characterized by relatively good light conditions and sparse litter. Further bryophyte diversity promoting factors were forest stand age, existence of deadwood and soil disturbances. But these factors are not directly correlated with forest management types.

Unmanaged forests did not reveal higher bryophyte diversity than managed forests in all Exploratories. The reason for that observation could be that these forests are only since few decades out of any land use. Typical attributes of real natural forests like high amount of dead wood and high tree species diversity are still missing.

Conclusion

Forest management has an impact on bryophyte diversity mostly by plantation of coniferous trees. Further effects are indirect and complex and not directly correlated with forest management types.

Management Recommendations For Bryophyte

JeriLynn Eloise Peck



Management Recommendations For Bryophyte:

Northern Spotted Owl Management Plan in the National Forests (CA,OR,WA) ,1992 Coastal Dune Management John Houston,Paul J. Rooney,Sally E. Edmondson,P. J. Rooney,2001-01-01 Elizabeth A Kaye specializes in communications as part of her coaching and consulting practice She has edited Requirements for Certification since the 2000 01 edition

Managing for Biodiversity in Young Douglas-fir Forests of Western Oregon ,2002 Toward the Sustainable Management of Commercially Harvestable Epiphytic Bryophytes JeriLynn Eloise Peck,2007 Coos Bay District Area Resource(s) Management Plan (RMP) ,1994 Bryophyte Biology Bernard Goffinet,2008-10-30 Bryophyte Biology provides an extensive overview of the hornworts liverworts and mosses diverse groups of land plants that occupy a great variety of habitats throughout the world This edition covers essential aspects of bryophyte biology from morphology physiological ecology and conservation to speciation and genomics Revised classifications incorporate contributions from recent phylogenetic studies Six new chapters complement fully updated chapters from the original book to provide a completely up to date resource New chapters focus on the contributions of Physcomitrella to plant genomic research population ecology of bryophytes mechanisms of drought tolerance a phylogenomic perspective on land plant evolution and problems and progress of bryophyte speciation and conservation Written by leaders in the field this book offers an authoritative treatment of bryophyte biology with rich citation of the current literature suitable for advanced students and researchers Eugene District Resource(s) Management Plan (RMP), Lane County, Linn County, Douglas County, Benton County ,1994

Klamath National Forest (N.F.), Thom-Seider Vegetation Management and Fuels Reduction Project ,2009

Okanogan-Wenatchee National Forests (N.F.), Natapoc Ridge Restoration Project, Chelan County ,2007 Sierra Nevada National Forest (N.F.), Managing California Spotted Owl Habitat in the Sierra Nevada National Forests of California, an Ecosystem Approach ,1995 Bryophyte Survey of Six Research Natural Areas Within the White Mountain National Forest, New Hampshire Natalie Laura Cleavitt,1996 **Antioxidant-Based Therapies for Disease Prevention and Management** Pallavi Singh Chauhan,Sonia Johri,2021-12-22 This informative volume presents a valuable overview of the therapeutic aspects as well as applications of antioxidants It discusses the basic mechanisms of therapy based oxidative damage and categorization of nutritional antioxidants and covers the sources of antioxidants as well as their extraction and quantification The volume considers the controversies of the usefulness or disadvantages of antioxidant supplementation in relation to adaptation and performance and also looks at the effectiveness of bioactives and antioxidant based therapies for specific health issues such as anemia infectious diseases urinary tract infections Parkinson s diseases and diabetes The book discusses the sensing of oxidative stress and the effectiveness of antioxidant treatment followed by an introduction to several biomarkers to estimate the bioefficacy of dietary supplemental antioxidants in various forms Also considered are free radicals that can cause oxidative stress a process that can trigger cell damage and how antioxidant molecules have been shown to

counteract oxidative stress in laboratory experiments Klamath National Forest (N.F.) ,1998 *Bryophytes* Matt von Konrat,2010 **Bryophyte Ecology and Climate Change** Zoltán Tuba,Nancy G. Slack,Lloyd R. Stark,2011-01-06

Bryophytes especially mosses represent a largely untapped resource for monitoring and indicating effects of climate change on the living environment They are tied very closely to the external environment and have been likened to canaries in the coal mine Bryophyte Ecology and Climate Change is the first book to bring together a diverse array of research in bryophyte ecology including physiology desiccation tolerance photosynthesis temperature and UV responses under the umbrella of climate change It covers a great variety of ecosystems in which bryophytes are important including aquatic desert tropical boreal alpine Antarctic and Sphagnum dominated wetlands and considers the effects of climate change on the distribution of common and rare species as well as the computer modeling of future changes This book should be of particular value to individuals libraries and research institutions interested in global climate change *Routledge Handbook of Forest Ecology* Kelvin S.-H. Peh,Richard T. Corlett,Yves Bergeron,2024-10-07 The Routledge Handbook of Forest Ecology is an essential resource covering all aspects of forest ecology from a global perspective This new edition has been fully revised and updated throughout to reflect the profound and unprecedented changes in both forests and climates since the publication of the first edition in 2015 The handbook reflects key developments in the field of forest dynamics and large scale processes as well as the changes that are now manifesting in different types of forests across the globe as a result of climate change It covers both natural and managed forests from boreal temperate sub tropical and tropical regions of the world In this second edition the breadth of the handbook has been expanded with new chapters on mountain forests monodominance pathogens and invertebrate pests and amphibians and reptiles in forest ecosystems Original author teams are complemented by the addition of new authors to offer fresh perspectives and the second edition places greater emphasis on the applicability of each topic at a global level The handbook is divided into seven parts Part I The forest Part II Forest dynamics Part III Forest flora and fauna Part IV Energy and nutrients Part V Forest conservation and management Part VI Forest and climate change Part VII Human ecology The Routledge Handbook of Forest Ecology is an essential reference text for a wide range of students and scholars of ecology environmental science forestry geography and natural resource management **Encyclopedia of Biological Invasions** Daniel Simberloff,Marcel Rejmanek,2011-01-02 Addresses all aspects of this subject at a global level including invasions by animals plants fungi and bacteria in succinct alphabetically arranged articles Featuring many cross references suggestions for further reading illustrations an appendix of the world s worst 100 invasive species a glossary and more From the publisher *Biology of Algae, Lichens and Bryophytes* Burkhard Büdel,Thomas Friedl,Wolfram Beyschlag,2024-03-06 As a reader of this book you will become familiar with current up to date comprehensive knowledge about all classes of eukaryotic algae the cyanobacteria and symbiotic interactions of algae and cyanobacteria with other organisms For example the lichens are symbiotic consortia and a prominent example of a particularly successful evolution by

cooperation We expand even to the beginnings of terrestrial plant life and the bryophytes which are gradually transmitting to the vascular plants We collectively call this enormous phylogenetic wealth of photoautotrophic organisms the new cryptogams abandoning the traditional definition of cryptogams The new cryptogams are all those autotrophic organisms that share being hydro passive meaning that they are unable of controlling water uptake or release in contrast to vascular plants While being basal of and phylogenetically much more diverse than the vascular plants the new cryptogams are ecologically highly relevant in all ecosystems of our Planet They are responsible for more than half of the Earth s annual oxygen production

Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts ,2008 England's Rare Mosses and Liverworts Ron D. Porley,2013-07-21 This is the first book to cover England s rare and threatened mosses and liverworts collectively known as bryophytes As a group they are the most ancient land plants and occupy a unique position in the colonization of the Earth by plant life However many are at risk from habitat loss pollution climate change and other factors Britain is one of the world s best bryologically recorded areas yet its mosses and liverworts are not well known outside a small band of experts This has meant that conservation action has tended to lag behind that of more charismatic groups such as birds and mammals Of the 916 different types of bryophyte in England 87 are on the British Red List and are regarded as threatened under the strict criteria of the International Union for the Conservation of Nature This book aims to raise awareness by providing stunning photographs many never before published of each threatened species as well as up to date profiles of 84 of them including status distribution history and conservation measures The book looks at what bryophytes are why they are important and useful and what makes them rare it also examines threats extinctions ex situ conservation techniques legislation and the impact of the 1992 Convention on Biological Diversity Provides the first treatment of England s rare and threatened mosses and liverworts Features stunning photographs many never before published of each species and many of their habitats Treats each species in a handy and attractive double page layout Includes up to date profiles of 84 species including status distribution history and conservation measures Presents the first overview of English bryophyte conservation Offers invaluable guidance to people working in conservation in England the British Isles Europe and beyond

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Table of Contents Management Recommendations For Bryophyte

1. Understanding the eBook Management Recommendations For Bryophyte
 - The Rise of Digital Reading Management Recommendations For Bryophyte
 - Advantages of eBooks Over Traditional Books
2. Identifying Management Recommendations For Bryophyte
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Management Recommendations For Bryophyte
 - User-Friendly Interface
4. Exploring eBook Recommendations from Management Recommendations For Bryophyte
 - Personalized Recommendations
 - Management Recommendations For Bryophyte User Reviews and Ratings
 - Management Recommendations For Bryophyte and Bestseller Lists

5. Accessing Management Recommendations For Bryophyte Free and Paid eBooks
 - Management Recommendations For Bryophyte Public Domain eBooks
 - Management Recommendations For Bryophyte eBook Subscription Services
 - Management Recommendations For Bryophyte Budget-Friendly Options
6. Navigating Management Recommendations For Bryophyte eBook Formats
 - ePub, PDF, MOBI, and More
 - Management Recommendations For Bryophyte Compatibility with Devices
 - Management Recommendations For Bryophyte Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Management Recommendations For Bryophyte
 - Highlighting and Note-Taking Management Recommendations For Bryophyte
 - Interactive Elements Management Recommendations For Bryophyte
8. Staying Engaged with Management Recommendations For Bryophyte
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Management Recommendations For Bryophyte
9. Balancing eBooks and Physical Books Management Recommendations For Bryophyte
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Management Recommendations For Bryophyte
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Management Recommendations For Bryophyte
 - Setting Reading Goals Management Recommendations For Bryophyte
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Management Recommendations For Bryophyte
 - Fact-Checking eBook Content of Management Recommendations For Bryophyte
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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