PREFACE

Forests are the most common terrestrial biomes, covering about 30% of the earth's land surface. Generally, about 10% of the primary production in forests is used by herbivores, while the remaining 90% enter the decomposition loop as plant litter, which includes leaves, wood, roots and other plant parts. Leaf litter production in forests ranges from about 100 to 1400 g dry mass m^{-2} $year^{-1}$, suggesting that decomposition is a vital process in the functioning of forest soils and forest ecosystems as a whole. Similar cases can be made for low-order woodland streams, where plant litter is a major energy source, for grasslands and wetlands, and for a range of other both aquatic and terrestrial ecosystems.

Decomposition of plant matter is a complex process that involves bacteria, fungi and invertebrates as well as physical-chemical processes. It is influenced by the chemical and physical properties of the decomposing plant material and by environmental conditions such as temperature, moisture and nutrient availability. A thorough understanding of these processes is critical not just to grasp the essence of ecosystem functioning but to predict consequences of global environmental change on carbon budgets at various scales. Because decomposition greatly affects the balance between carbon dioxide returned to the atmosphere and long-term carbon sequestration, solid knowledge of the rates, pathways and controls of decomposition has become imperative to making informed ecological forecasts of carbon cycling in altered environmental conditions and of the feedbacks on climate.

Given the significance of the process, it is not surprising that ecologists have studied litter decomposition at least since Darwin. An upsurge occurred when the use of litter confined in boxes and open-ended tubes, later in mesh bags, was introduced in the 1930s. Methods have since been substantially broadened and refined, even though some basic approaches such as the mesh-bag technique are still useful and widely employed.

This book is the outcome of several editions of an international "Advanced Course on Litter Decomposition" held since 1998 at the University of Coimbra, Portugal. The courses aimed at introducing graduate students and postdoctoral scientists to a range of methods that have been used to advance understanding of the litter decomposition process. Emphasis was on ecological field methods, associated chemical, microbiological and enzymatic analyses, and involvement of detritivorous invertebrates. The idea of publishing the experimental protocols presented in the courses followed the request from participants and a number of colleagues wishing to have the teaching material in printed form. Consequently, the focus of this "recipe" book is on the description of specific procedures. A companion book addressing the background of different methods and evaluating the usefulness in different contexts is currently in preparation.

The primary target audience of this book includes graduate students, instructors of specialized and general ecology courses, and professional scientists working on organic matter dynamics in both aquatic and terrestrial ecosystems. Most of the contributing authors have a research background in stream ecology. This bias is reflected in the book. Some of the described methods will thus be specific to streams and rivers; others will require adaptation when applied to other ecosystems. However, the majority of proposed procedures will be applicable to aquatic and terrestrial systems alike, and many will also be useful to characterize fractions of organic matter – and processes and biota associated – other than decomposing plant litter in natural environments.

A number of individuals have contributed to this book. We are particularly grateful to the participants of the courses for their questions and comments which improved the presented protocols. Our special thanks go, of course, to the authors of the chapters for delivering their manuscripts on time (mostly) and particularly for their great patience during the editing phase when confronted with our numerous queries, comments and suggestions. We believe this effort was worthwhile and hope users of the methods will share this perception.

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