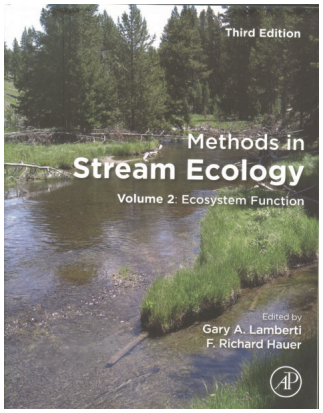

Methods in Stream Ecology, Third Edition – Volume 2: Ecosystem Function. Gary A. Lamberti and F. Richard Hauer (eds). Academic Press, an Imprint of Elsevier, 125 London Wall, London EC2Y 5AS, UK. 2017, x + 362 pages. Price: US$ 55.97. eBook ISBN: 9780124165786, Paperback ISBN: 9780124165588.

Streams contain surface and groundwater fluxes, responding to geological, geomorphological, hydrological and biotic control in a region, which form a decisive part of the earth's water circulatory system. Surface water flowing within the bed and banks of streams transports sediments, nutrients and other materials into streams, rivers and lakes, and onto the ocean. Streams perform vital ecosystem functions such as providing habitat (for aquatic and terrestrial biota), mitigating instances of floods, groundwater recharge, provision of drinking water, bioremediation, etc. Stream ecology encompasses the ecology of flowing waters, including the study of energy and nutrients transfer through water flow, freshwater ecosystems, synthesis by organisms either directly from the environment (plants) or through their food (animals, fungi, bacteria and protists). This book provides insights into the concepts of ecosystem function, encompassing community interactions, ecosystem processes and ecosystem quality with field and laboratory protocols, which are useful for teaching and research. This edition has been updated to reflect recent advances in the technology associated with ecological assessment of streams, including remote sensing. It also includes supplementary details in watershed ecology/science, hydrology, fluvial geomorphology and landscape ecology, which are useful for teaching. Each chapter provides exercises to ensure self-learning by the students in addition to detailed instructions, illustrations, formulae and data sheets, and taxonomic keys to common stream invertebrates and algae for enabling field research by the students. Inclusion of web addresses or URLs with tables and links provided by leading experts in stream ecology is immensely helpful to the field researchers. This publication has two volumes (Volume 1 and Volume 2). To facilitate transition between the two volumes, editors have sequentially numbered the chapters from 1 to 40, with volume 1 containing 22 chapters and volume 2 containing 18 chapters.

Volume 1, *Ecosystem Structure*, focuses on the various structural components of streams. 22 chapters have been organised into three sections: (A) Physical Processes, (B) Stream Biota, and (C) Community Interactions.

Volume 2, *Methods in Stream Ecology: Ecosystem Function*. 18 Chapters have been organized into three sections: (D) Organic Matter Dynamics, (E) Ecosystem Processes, and (F) Ecosystem Assessment.

Biological communities in an aquatic ecosystem are trophically supported by organic matter produced either through autochthonous or allochthonous sources from the respective watershed. The total organic matter (TOM) load is composed of particulate organic matter (POM) and dissolved organic matter (DOM). Section D consists of seven chapters (23–29) discussing standard protocols to collect, characterize and analyse the organic matter of streams, complemented with methods to manipulate organic matter to answer intriguing scientific questions. Chapter 23 presents the methods for using stable isotopes to trace the flow of organic matter, produced both internally and externally, through stream food webs and includes specific applications for impacted systems. Subsequent chapters in this section work through different forms of organic matter, historically based on dissolution or particle size. Chapter 24 describes DOM, which dominates TOM content in streams. Chapter 25 brings out details of the fine particulate organic matter (FPOM) that supports an array of filter feeders and other ecosystem processes. Chapters 26 and 27 deal with the visible coarse particulate organic matter (CPOM), such as leaves. Chapter 26 deliberates methods for manipulating CPOM to understand aspects of retention, carbon cycling and the responses of food webs to CPOM loading. Leaf litter plays a crucial role in food webs of streams; hence in chapter 27, both classical and modern approaches to study the decomposition and breakdown of leaf litter are presented. The next chapter examines the riparian zone, which aids as a habitat and acts as a noteworthy source of organic matter. Chapter 28 also provides methods to characterize this critical ecotone affecting stream function, including remote-sensing approaches. Chapter 29 concludes with a treatment of large wood (LW), including modelling exercises for estimating LW abundance and dynamics during stream restoration efforts. Overall, this section presents diverse and tested methods for measuring and manipulating the organic matter of streams, and provides clear linkages of ecosystem structure and function.

The fundamental ecological processes of ecosystems are the water cycle, biogeochemical (or nutrient) cycling, energy flow and community dynamics, i.e. how the composition and structure of an ecosystem changes following a disturbance (succession). The concept of a downstream 'nutrient synthesis' for important elements such as carbon (C), nitrogen (N) and phosphorus (P) has stimulated recent research on how nutrients cycle through microbial and macrobiotic compartments in streams. The seven chapters (30–36) in section E address the dynamics of important functional processes in streams with a focus on the cycling of important elements and their ultimate fate in lotic biota, which may culminate in primary and secondary production. Chapter 30 presents the fundamental concepts and methods of investigation of nutrient spiralling in streams, with a focus on the theoretical basis for measuring the downstream advection and dispersion of bioreactive and nonreactive elements carried with water. Chapters 31–33 build on this foundation by presenting approaches for measuring the dynamics and transformations of specific reactive solutes in streams. Chapter 31 describes the use of nutrient diffusing substrates for determining the nutrient status of streams, as well as using constant releases of stable isotopes for measuring rates of nutrient uptake along stream courses. In chapter 32, methods to measure specific transformations of N, a critical and highly reactive element in streams, are

described with field and laboratory protocols. Chapter 33 presents methods for determining the dynamics of P, a major nutrient playing a critical role in the biochemical apparatus of all organisms, and includes exercises using both stable and radioactive forms of P to interpret uptake and cycling. This section then shifts to methods to measure the productivity of streams and the incorporation of these critical elements into the biota. In chapter 34, major advances in methods to determine the 'metabolism' of streams from measures of dissolved oxygen dynamics are described, including modern modelling techniques for assessing production and respiration. In chapter 35, classical methods for measuring the secondary production of streams with a focus on benthic macroinvertebrates as indicators of environmental quality are described along with detailed exercises. Finally, chapter 36 explains the emerging field of 'ecological stoichiometry', whereby useful insights into stream function are provided by measuring the elemental content of stream biota, especially C, N and P. Overall, this section provides vital understanding of the concepts with a sound foundation for measuring the cycling and fate of important elements in streams and rivers, and highlights how much is yet to be discovered about the functioning of these unique ecosystems.

Ecosystem assessment refers to an evaluation of environmental conditions such as a proposed plan, policy, or programme that could have a measurable effect on the ecosystem. In section F, chapters address the theory and methods behind using biota as indicators of natural, impacted and impaired stream systems. Chapter 37 provides a basic framework for conducting ecological assessment using the ubiquitous benthic algae; methods include basic rapid bioassessment protocols as well as development of metrics to evaluate ecological integrity. In chapter 38, methods to measure and evaluate stream macroinvertebrates, which are known to respond dramatically and with taxon specificity to a wide variety of pollution types, are described and include advanced approaches to metric development and application. Chapter 39 provides the basis for criteria and stressors affecting multiple measures of fish assemblage structure and function, and 'brings to life' the utility of stream fishes in the Index of Biotic Integrity. Chapter 40 focuses on the integration of laboratory, field and experimental studies, and the identification of cause-and-effect relationships that permit the development of 'weight-of-evidence' in ecological risk assessments for streams and rivers. These four concluding chapters on the methods in stream ecology illustrate the breadth of application and knowledge needed across the multiple sub-disciplines of stream structure (volume 1) and stream function (volume 2) to develop comprehensive and tested methods for assessment of environmental health and ecological integrity of stream ecosystems.

This book is well structured and organized with a compilation of articles written by the globally acclaimed field researchers with vast experience; they have been successful in presenting domain concepts lucidly in the respective chapters, which are conducive for teaching and learning. The publication would be immensely useful to all students, researchers and practising, ill-informed technocrats in stream and freshwater ecology, freshwater biology, marine ecology, river ecology, management of water resources, etc. Doable, stepwise exercises and self-assessment techniques certainly aid the students and teachers in performing experiments related to streams inventorying, mapping and monitoring. The book is useful as good reference material to the teaching faculty, graduate students, researchers, advanced undergraduates, and government officials interested in and responsible for stream evaluation and monitoring. The libraries in all educational institutions and water resources management agencies across all regions in the globe should have copies of this book (as well as vol. 1), and must be made compulsory reference book for students (undergraduate and Masters) of science and engineering courses. More importantly, practising engineers and technocrats should undergo training (curriculum based on both vols 1 and 2), so that instances of flooding, etc. associated with water resources mismanagement could be mitigated through sustainable management of aquatic ecosystems with proper understanding of linkages of ecology, hydrology and biodiversity with the catchment land-use dynamics.

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