



Integrated Watershed Management
- Ecohydrology & Phytotechnology -
- Manual -



PART ONE: INTRODUCTION





1.A. What is the goal of this Manual

ECOHYDROLOGY & PHYTOTECHNOLOGY PROGRAMMES

The concept of ecohydrology and its scientific foundations were developed by International Hydrological Programme (IHP) of UNESCO. According to ecohydrology, through the manipulation of biota and hydrology interactions in a landscape, the possibility of augmenting ecosystems resilience to anthropogenic changes can be achieved.

Phytotechnology, on the other hand, as the use of vegetation and its natural services for environmental quality improvement, is being developed by the UNEP International Environmental Technology Centre (UNEP - IETC). This can complement ecohydrology through, for example, development of techniques of vegetation use to reducing erosion of shorelines, preserving and restoring soils and landscapes, controlling and preventing pollution, as well as restoring habitats.

ECOHYDROLOGY & PHYTOTECHNOLOGY GUIDELINES FOR IWM

The complementarities of ecohydrology and phytotechnology, together with the similar interests in water resources management of UNEP-IETC, UNESCO-IHP and UNESCO-Regional Bureau for Science in Europe (ROSTE), led to a joint project that produced the „Guidelines for the Integrated Management of the Watershed”. The Guidelines provided a strong scientific basis for the concepts of ecohydrology and phytotechnology as well as a theoretical background for their application in Integrated Watershed Management (IWM). They presented ecohydrological approach to understanding of processes regulating dynamics of water basins, as well as the mechanisms for increasing absorbing capacity of ecosystems against human impacts.

THIS MANUAL

Being a continuation of the scientific background provided in the „Guidelines”, this publication does not present to a reader any detailed theoretical considerations about the mechanisms of the ecohydrological and phytotechnological processes. Discussion of the theoretical aspects of the concepts in this publication is limited to an essential minimum. The Manual complements the Guidelines and focuses on the methodology and practical aspects of implementing ecohydrological and phytotechnological concepts in watershed management.

Therefore, the objectives of this manual are to:

- ▶ provide examples of ecohydrology and phytotechnology in water resources management;
- ▶ assist decision makers, technical experts and scientists to manage watersheds and related water bodies; and
- ▶ facilitate and promote the better understanding of the opportunities that the application of ecohydrology and phytotechnology offer for this purpose.

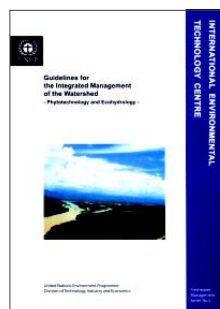
HOW TO USE THE GUIDELINES AND MANUAL

In order to benefit from both practical information presented in the Manual as well as the scientific background provided by the Guidelines, it is recommended to get familiar with both of the complementary publications.

Therefore, in the section named:

MAKE SURE TO CHECK THESE RESOURCES:

located at the end of each chapter, you will find references to corresponding chapters of the UNEP / UNESCO Guidelines for the Integrated Management of the Watershed - Phytotechnology and Ecohydrology.



UNESCO/UNEP
*Guidelines for the Integrated Management
of the Watershed
Phytotechnology and Ecohydrology
Freshwater Management Series No. 5
UNEP, 2002*

1.B. WHY IS THIS MANUAL NEEDED?

FRESHWATER DEGRADATION IS MUCH MORE THAN JUST POLLUTION

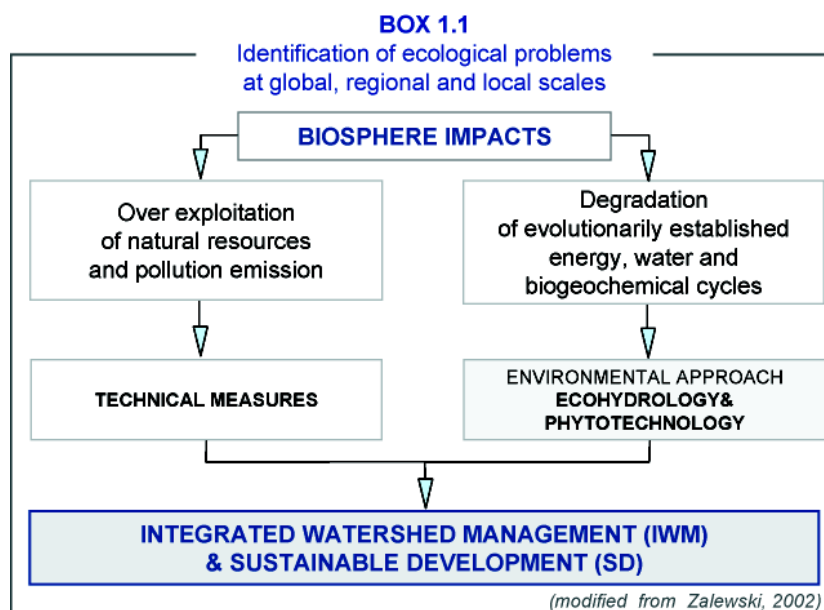
At the beginning of the 21st century, the increasing human population has become a major factor in progressive environmental degradation on the global scale. Although the traditional perception of freshwater degradation has been usually linked to pollution, increasing human activities in a catchment have more profound effects on environmental quality. Most river basins in the world have been dramatically modified due to unsustainable development of agriculture, grazing, deforestation, and urbanization. These disturbances have been changing local and regional climates, hydrological cycles as well as evolutionary established biogeochemical cycles in a catchment. Therefore, it became evident that the degradation of river ecosystems has been of a two-dimensional nature (Box 1.1):

- ▶ first - pollution, which can be eliminated to a large extent by technologies;
- ▶ second - and much more complex, degradation of evolutionary established water and nutrient cycling.

WHY DOES THE DEGRADATION OF ECOLOGICAL PROCESSES CAUSE RISK TO HUMANS?

Degradation of biological structures and ecological processes means a reduction in an ecosystem's

carrying capacity. As a consequence, with the present rate of society development and environmental degradation, it is expected that during the next 30 to 60 years, human imperatives may clash with the carrying capacity of the global environment (see Guideline, chapter I). Such a clash would be nothing less than catastrophic for humanity. Today changes of ecological processes at a catchment scale have become strongly manifested by the continuous decrease of water quality and the enhanced risks of floods and droughts in many regions of the world. It is evident that water is becoming scarcer for society in some developed and many developing countries. This results in a higher risk to not only human health, but also to economic and societal development. In this situation, development of an integrated approach to environmental management, based on the harmonization of technical and ecological measures, is necessary to achieve sustainable development. Integrating different branches of environmental science (such as, e.g., ecology and hydrology) can help provide an understanding of environmental changes as well the knowledge-base necessary to apply efficient measures to improve the quality and, at the same time, increase absorbing capacity of the environment for human impacts.



1.C. WHAT IS COVERED BY THIS MANUAL?

This manual provides a new approach based on application of across disciplines knowledge in holistic management of water resources. It encourages a reader to have a broader, interdisciplinary view on various aspects of IWM, with special emphasis on practical use of understanding relationships between hydrology and biota and their use in order to control environment quality.

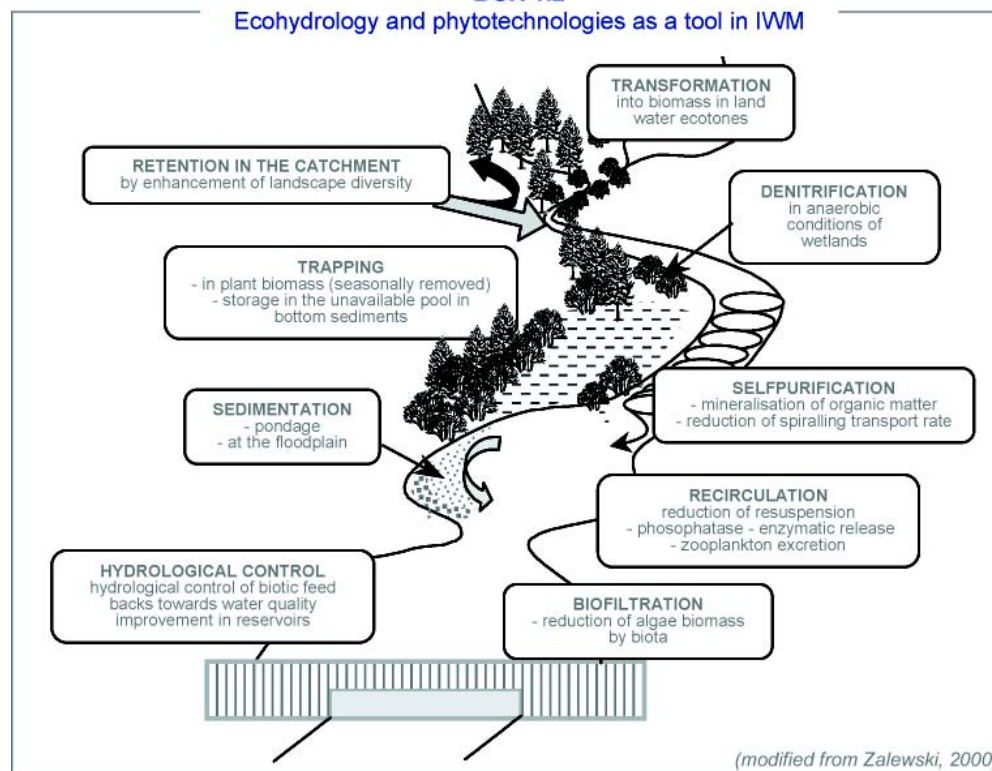
According to the presented approach, for sustainable management of water resources quality and stabilization of hydrological cycle, it is necessary to harmonize technological and ecological measures. Ecological measures should be based on understanding of biota-water interplay in various scales of a catchment. Therefore, the manual has been organized hierarchically, in order to easily identify the necessary measures in the particular areas of a catchment, such as (Box 1.2):

- ▶ **LANDSCAPE**
- ▶ **LAND-WATER INTERFACE**
- ▶ **STREAMS & RIVERS**
- ▶ **LAKES & RESERVOIRS**
- ▶ **ESTUARINE & COASTAL AREAS**

The manual has been divided into the following major sections:

- ▶ **PART ONE: INTRODUCTION:** presents basic theory for ecohydrology and phytotechnology concepts and introduces basic definitions essential for understanding in order to apply ecohydrological and phytotechnological measures.
- ▶ **PART TWO: SURVEYS & ASSESSMENT:** presents an overview of methods for assessment of potential issues in watersheds, focusing a reader's attention on possible variations and interpretations of results from the point of view of ecohydrology and phytotechnology.
- ▶ **PART THREE: MANAGEMENT:** presents practical suggestions and recommendations for application of ecohydrology and phytotechnology in IWM.

BOX 1.2
Ecohydrology and phytotechnologies as a tool in IWM





1.D. WHO SHOULD USE THIS MANUAL?

Anyone who is involved in Integrated Watershed Management (IWM) should find this manual of interest. In particular, those who deal with **improvement** of degraded aquatic and terrestrial environments, as well as those interested in **sustainable management and maintaining** good quality water resources, will find this manual useful.

In the traditional approach to water resources management, hydrotechnical engineers have usually been the major target group. Although they still play a fundamental role as those who **eliminate threats**, such as for example, point sources of pollution, it has become obvious that to achieve high-quality results with environmental issues, the technical approach alone is not enough. This manual encourages and provides an understanding of the need for a **broader view** on catchment management. This involves the

application of new strategies that amplify the opportunities provided by an understanding of ecosystem properties in order to enhance their **carrying capacity** against increasing human impacts.

Successful implementation of any strategy in IWM depends on participation of various groups of people working and living in a catchment (Box 1.3). Therefore, we believe, that not only professionals with various expertise, but also a wide range of practitioners, politicians and the public will find the manual of interest. In particular, the manual has been dedicated to:

- ▶ environmental managers and technical experts;
- ▶ local and regional authorities, decision makers in government agencies and non-governmental organizations;
- ▶ coordinators and consultants; and
- ▶ landowners.

BOX 1.3

Changing the stakeholder involvement in IWRM
Stakeholder music festival with 2000 sicuris in front of the River Huasamayo

