

FORESTS AND WATER

Traditional Forest Hydrology and Beyond

Editors

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INTRODUCTION

Clean water is fundamental human need. Globally, one in six people still do not have access to clean water even today. Although the target of halving, by 2015, the proportion of people who are unable to reach or afford safe drinking water, was adopted at the United Nations Millennium Summit in 2000 (FAO, 2013). There will still be by the year 2025, 1.8 billion people living in regions with absolute water scarcity.

Forests influence the quantity and quality of available water and regulate surface and groundwater flows. The most significant contribution of forests in the hydrological cycle is in maintaining high-quality water through reduction of soil erosion and sedimentation and bio-filtering other water pollutants. Riparian forests along stream channels and drinking water supply forested watersheds present the best examples of maintaining water quality.

The dense and deep root system of forest soils and the high porosity of the surface litter make for excellent water infiltration and retention capacity. Natural sponge function of forests reduces surface runoff during the wet seasons and recharges ground water more efficiently. As a result, they provide hydrological regulatory functions for stream flow during the year. Many of the forests, therefore, constitute head water catchments for large rivers and play a major role in regulating the hydrological services in the river basins and beyond. These forested catchments also account for a high proportion of water supplied for domestic, agricultural, industrial and ecological needs in both upstream and downstream areas. However, it must be acknowledged that a greater quantity of water is given back to the atmosphere through evapo-transpiration affecting the water yield especially in arid or semi arid conditions.

Forests and water form the basis of foundation for terrestrial life through ecological functions. Forest management is thus a tool for maintaining and developing the dynamic relations between forests and man. It is guided by his changing needs and scientific understanding of the forests ecosystems. Consequently there has been a paradigm shift in forest management also over the years from timber centric management to multiple functions' forestry. It is recognised that the forests are also sources of water (surface, sub-surface and ground water). Over-exploitation of the ground water resources results in declining ground water levels; necessitating augmentation of the ground water resources through suitable management interventions. Further forest management practices are being dovetailed with the principles of watershed based development approach especially in the source areas of water. Such areas have restrictions on tree felling along with suitable prescriptions to improve the water regimes and natural regeneration. Heavy rains and rapid run-off severely affect not only the top fertile soil but leads to formation of gullies within forest areas. Suitable management imperatives are formulated and implemented to stop forest degradation due to natural causes and calamities. Apart from silvicultural operations, appropriate prescriptions are also made for conservation of soil and water in the forest areas. Areas susceptible to soil erosion such as steep slopes and areas in the vicinity of perennial streams are the focus of soil

and water conservation interventions. There is greater emphasis on maintenance and enhancement of riparian forests along streams for their hydrological regulatory functions for improved quality and quantity of water availability for mankind.

Forest hydrology deals with this interaction between forests and the water cycle providing useful information for the much needed efforts to maintain and enhance hydrological regulatory functions of forests. Traditional forest hydrology has over the years focused on direct effects of forest management on hydrological processes from plot study, process study and watershed experiments. Today, the challenge before us is to apply these principles to predict how hydrologic processes respond to the many forms of change, including climate change, in forest landscapes. As a consequence, research in forest hydrology has shifted towards the study of reforestation hydrology, large-scale watershed hydrology, climate change impacts, and application of hydrological models using modern tools and techniques. This allows for analysis of forest and water connections over large areas to make predictions about forests and water that can address current and anticipated future issues, including cumulative watershed effects, climate change, and forest management practices.

The present book is a synthesis of various forest hydrological studies, review papers, application of modern tools and techniques in forest hydrology and case studies on management interventions for better augmentation of water sources from Asia Pacific region. The book has five thematic sections. Theme I, Forest Hydrology, covers papers on hydrological studies establishing interactions between forest biophysical conditions and hydrological parameters from Philippines, China, India, Nepal. Theme II, Forest Hydrology and Climate Change, examines the potential climate change impacts on forest hydrology, impacts of removal of forests on hydrology and the response of hydrological characteristics to climate change. Theme III, Forestry and Soil & Water Conservation looks at the role of forests in the context of soil and water conservation, in reducing water, soil and nutrient losses and their impacts on livelihood security and prevention of degradation. Theme IV, Water Quality, examines the role of water management practices in forested catchments on the quality and quantity of surface waters. Theme V is a collection of case studies addressing impacts of degradation, deforestation and climate change on water resources and the role of communities in management of water resources.

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