Preface

Taihu Lake basin is located in the core area of the Yangtze River Delta; the total area of the basin is 36.9 thousand km^2 of which the water area of Taihu is 2338 km^2, covering Jiangsu, Zhejiang, and Anhui provinces and Shanghai city. Owing to favorable climate and natural conditions, this region was developed very early and is playing an important role in socioeconomic development of China. In 2005, the GDP (gross domestic product) of the basin area accounted for about 11.7 % of the whole country.

With a rapid development of economy and society in Taihu Lake basin, the water consumption and wastewater discharge are increasing, and the water quality of the basin is declining since past 30 years. During 2005, the water quality of the lake basin along the watershed of 2700 km long was studied and found that for over 89 % of the basin, the annual water quality deterioration was of class III standard, and 61 % was worse than the class V standard. The average water quality comprehensive evaluation of Taihu Lake was for the inferior class V (including TP (total phosphorus), TN (total nitrogen) index), whereas the NH_3^--N index was for the class II, TP was for class IV, TN index was inferior to the class V, and COD_{MN} (chemical oxygen demand) was for class III.

Among various factors of water pollution and eutrophication in Taihu Lake basin, the contribution of non-point source pollution is crucial. The statistics of the Taihu basin showed that the contribution of non-point source pollution to the drainage was around 347,000 tons of COD and 2.5 million tons of NH_3-N. According to an estimate of the former State Environmental Protection Administration, the water pollutants in the country from the industries, human living, and agricultural non-point source pollution were approximately 1/3 each. Of the pollution load in Taihu Lake, 83 % of TN and 84 % of TP were from farmlands, rural livestock and poultry breeding industry, urban and rural combination areas, and rural life. The contribution of non-point source pollution was far more than point source from industries and urban life. In the plain area of Taihu Lake basin, addition of COD to the rivers was 346.9 thousand tons per year with the largest proportion from rural human living, accounting for 41.6 % of the total COD in the river, followed by aquaculture production, accounting for 27.2 % of the total COD. The addition of TP to the rivers was 6.7 thousand tons per year with the largest proportion from rural life, accounting for 50.6 % of the total TP, followed by farmland runoff pollution, accounting for 26.9 %. The addition of TN to the rivers was 64.8 thousand tons per year with the biggest share from rural human living, accounting for 32.8 % of the total, followed by livestock and poultry breeding, accounting for 23.9 %. In specific, addition of NH_3-N to the rivers was 25.1 thousand tons per year with the largest proportion from rural life, accounting for 60.2 % of the total, followed by farmland runoff pollution, which accounted for 26.7 % of the total. Thus, there are various sources for pollution of rivers and lakes, i.e., TN and NH_3-N are the largest pollutants in rural areas, rural life, and farmland runoff, while TP is more in rural life and livestock and poultry farming. Thereby, it is not difficult to understand why in 2007 blue-green algae broke out in Taihu Lake.

In order to overcome the serious non-point source pollution in Taihu Lake watershed, the following measures are generally taken: (1) **Ecological ridge technology**: Runoff is an important way of nutrient loss. The current farmland ridge is only about 20 cm high in the farming area of Taihu Lake basin which can produce surface runoff easily at the time of higher rainfall. It is estimated that by heightening the existing ridge by 10–15 cm, the runoff from 30 to 50 mm rainfall can be effectively prevented and can reduce most of the farmland runoff. At the same time, some plants can be planted on both sides of the ridge to form a buffer zone, which can effectively check surface runoff and thereby reduce nutrient losses through runoff water. (2) **Ecological ditch technology:** Currently, most of the ditches are with hard cement surface which results in the discharge of surface runoff directly into rivers causing eutrophication of water. Therefore, it is wise to change the existing channels to hardened eco-channels by hard boards with holes which make the crops or grasses to grow and absorb nutrients from the leaching water. By this way, the loss of farmland nutrients can be effectively intercepted. At the same time, certain plants can be planted at the center of the ditches, which can reduce the velocity of water flow, increase the retention time, improve crop nutrition, and also improve self-purification capacity of water bodies. (3) **Ecological wetland treatment technology:** Through the construction of ecological ditches and ecological interception system, most of the nutrients lost from farmlands can be intercepted, but still some nutrients go into the river. Man can take advantage of the existing ecological wetlands or artificial floating islands by planting emergent plants, leaf floating plants, etc., to fully absorb and utilize these nutrients. The hydraulic plants having some economic value can be selected to ensure certain economic benefits to local farmers besides improving water quality.

Forestry measures play a certain role in controlling non-point source pollution and protecting water security. In order to understand the role of forestry measures on water quality improvement, some projects have been undertaken since 2008 which are supported by State Ministry of Science and Technology and Department of Science and Technology of Jiangsu Province. This book has been written based on the research findings of the projects.

This book mainly focuses on ecological approaches of preventing and controlling non-point source (NPS) pollution based on forestry measures. Firstly, the characteristics of NPS pollution in Taihu Lake watershed and water eutrophication evaluation methods are described. Then, the role of relevant forestry measures in combating water pollution such as public welfare forest development, urban forestry development, techniques of hedgerows planting in slope lands, shelter belt establishment, N and P absorption by willows, hydrophyte selection, and land use pattern optimization is presented. Correspondingly, quantified data on the effect of forestry measures on soil properties, plant species diversity and source reduction and sink increase of NPS pollution are given in this book. Moreover, for the first time, the landscape change and its effect on water quality in Taihu Lake are discussed, in addition to purification of eutrophicated water and dynamic kinetics of nitrogen absorption by trees. Finally, the techniques of development of riparian forest buffers and ponds–wetlands integrated management system are indicated and described.

This book is useful for researchers, lecturers, professionals, and administrators working on water environment and ecological development as well as graduate students, senior undergraduates, and persons interested in water security.

Hongzhou, China Jianfeng Zhang
April 2016

Springer

http://www.springer.com/978-981-10-1849-7

Forestry Measures for Ecologically Controlling Non-point
Source Pollution in Taihu Lake Watershed, China
Zhang, J.
2016, XVI, 289 p. 166 illus., 119 illus. in color.,
Hardcover
ISBN: 978-981-10-1849-7