

## Chapter 25

# Role of Free and Open Source GIS in River Rejuvenation

**Smart Kundassery**

*Cochin University of Science and Technology, India*

**Babu C. A.**

*Cochin University of Science and Technology, India*

### ABSTRACT

*Rivers represent one of the sources of freshwater. The existence and survival of humanity is intricately connected with the availability of freshwater resources. It is valuable to provide comprehensive information of all water resources through online geo-visual interfaces. Specific web slices can be of use, such as the illustration of headwater sources along with details of streams of various orders and tributaries up to the point of merging with the sea downstream. Since the local self-government departments, Grama Panchayat, can play a crucial role, they too are eager to know the details of the drainage network flowing within each administration unit. The possibilities emerging out of integration of free and open source GIS is enormous and can eventually succeed in bringing forth a ray of hope to the forlorn riverine ecosystem.*

### INTRODUCTION

The water resources perform a pivotal role in sustaining life on the Planet Earth. Myriad forms of flora and fauna flourish and nourish through the intake of water. Human race too is not an exception. For the humanity to sustain and thrive on the Planet Earth, the indispensable prerequisite is the availability of freshwater. All cross-sections of the society, primitive and present, have depended on freshwater for subsistence. In the terrestrial landscape, the major sources of freshwater are the rivers. Ample supply of freshwater from the rivers well ensured and nurtured the initial vibes of the civilizations to sprout along the valleys of rivers, be it the Tigris-Euphrates river valley (4400 B.C.-2000 B.C.) along the Tigris and Euphrates rivers in Mesopotamia (Jason, 2010), Harappan civilization (2300 B.C.-1700 B.C.) along the Indus river valley (Fairservis, 1967), Nile river valley (3000 B.C.-30 B.C.) along the Nile river in Egypt and Yellow river valley (2100 B.C.-1 A.D.) along the Yellow river in China (Gernet, 1996). These civili-

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zations are hence aptly known ever since as the river valley civilizations. Manifold ecological functions are infused by the rivers and extended numerous invaluable services to the ecosystem as well. The river continuum is thus regarded not just a flow of water over terrestrial landscapes but a flux of energy and matter of immense ecological concern.

Ever since the dawn of the civilizations, the rivers have espoused a momentous role in many religious ceremonies too. Most of the rivers of India are depicted as the avatars of Goddesses. Consequently, the rivers upheld a divine status and waters hold significant role in the holy rituals. The largest of the certain massive human congregation (Figure 1) occur alternately in the banks of the rivers, viz. the Ganges at Haridwar; the confluence of the Ganges and the Yamuna and the mythical Saraswati at Allahabad; the Godawari at Nashik; and the Shipra at Ujjain. On reminiscence, the rivers are thus indeed a living and sacred entity in holistic insights and not just a commercial commodity awaiting exploitation. In recognition of the many facets rivers enrich human life and endeavour, United Nations General Assembly has declared 2003 as the 'International Year of Freshwater [55/196]'; 2005-2015 as the International Decade for action, with the focal theme "Water for Life" (United Nations, 2004). The year 2013 is observed as the 'International Year of Water Cooperation', United Nations, 2011). 'World Rivers Day' is being celebrated on the last Sunday of September. Apart from these, annually, March 14 is observed as the 'International Day of Action for Rivers'. 'World Water Day' is observed on March 22 every year.

In quintessence, the vitality and vibrancy of the Nature is exalted by numerous rivers gushing across the planetary terrain. However, world over, the rivers are facing interferences from various natural as well as human induced processes. The natural processes are often related with the variations associated with the global warming and climatic changes. The human induced processes have multifarious roots. For long, the creation of dams and reservoirs were a compelling necessity for the prevention of recurring floods, generation of electricity and irrigating large tracts of lands. Later, in the process, the structures caused physical alterations to the river flow, caused irrecoverable damage and disturbance to the riverine system and even blocked the migration routes (Marmulla, 2001) of fishes (Figure 2). Eventually, the dams fragmented the natural floodplains of rivers to the utmost destructive extent (Figure 3/4). Unabated deforestation in the catchment area enhances the risk of catastrophic floods to a considerable extent. The natural forests are highly efficient in storing the precipitation and reduce the direct runoff. The loss of the forests, wetlands, grasslands and floodplains exasperated the flood risk factor. The best illustration of this intricately correlated scenario is the summer floods in the Yangtze River in China during 1998 (Zhou, et al., 2002). Excessive water abstraction for agricultural irrigation, urban consumption, industrial use and pollution cause immense threat to the riverine system. Threats to rivers are on the rise.

Consequently, the rivers are undergoing a fast-paced shrinkage of the headwater sources. The emerging scenario of the scarcity of water trends the water resources as a precarious entity. Globally, critical scenarios have already evolved to adopt fair water usage. The incurring compulsion calls for the effective management of the available freshwater resources. All the freshwater resources with dim prospects have to be identified for revival and rejuvenation. The free and Open Source Geographical Information System (GIS) has a significant role in aiding river revival and rejuvenation processes.

## **WATER RESOURCES ON THE PLANET EARTH**

In the Solar System, the human race resides in a habitat known as the Planet Earth. The Planet Earth is one among eight planets in the Solar System. As of now, these eight planets together are endowed with

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