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Original Research

Palynofacies and sediment texture response from sub-tropical mixed sub-urban to urban floodplains of the Gomati River, Lucknow, India

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ABSTRACT

Hydromorphodynamic interactions with vegetation are a part of fluvial biomorphodynamics in actively meandering rivers. Using palynofacies and grain size from sub-urban to urban reaches across the river valley, the spatial patterns of organic matter behavior are examined in a 38 km reach of the Gomati River in Lucknow District, Uttar Pradesh, India. This is done to understand how they respond to the alteration, preservation, and degradation after getting transported and deposited in sediment. Thirteen surface sediment samples of the Gomati River floodplain were analyzed for palynofacies and grain size to ascertain its fate in this reach, which comprises the big picture for past human settlement. The shifts in the proportions of palynofacies associations, i.e., phytoclasts, palynomorphs, and amorphous organic matter (AOM) along with grain size, are considered to visualize the depositional process. The CONISS cluster analysis revealed four zones reflecting high degradation and alteration of palynofacies in the urban regime compared to the sub-urban reaches where the low interference with natural settings illustrates the low deterioration of palynofacies. The relation between grain size and palynofacies was obtained using Principal Component Analysis (PCA) to emphasize the correlation with palynofacies in the meandering fluvial system of the Gomati River. In the floodplain deposits, the behavior of palynofacies, allows for the distinction of the regional aspects of fluvial sediment disposition. The current study compares urban and sub-urban settlement premises of today's communities and contributes to the understanding of the growth, dispersal, and decline of earlier human settlements.

1. Introduction

Floodplains are regions of land adjacent to a river that stretches from the channel's banks to the foot of the valley's surrounding walls and is subjected to flooding during times of heavy flow with soil composition composed of clay, silt, sand, and gravel that floods left behind. Due to their high soil fertility, these deposits include nutrients and water in the form of organic matter and help to provide some significant agricultural regions, such as in the Mississippi River basin and the Nile River basin (Aslan, 2003; Kovács, 2013).

Fluvial geomorphological and biological processes shape river landscapes (Aslan, 2003; Asselman & Middelkoop, 1995; Gurnell et al., 2012; Kleinhans et al., 2018, 2019; van Oorschot et al., 2016). Due to the fertile nature of the soil and freshwater availability, both agricultural and urban sectors grow close to or on floodplains with large rivers such as the Ganga, Mississippi, and Nile as typical examples (Aslan, 2003; Jain & Tandon, 2010; Kovács, 2013; Singh, 1996; Tandon & Sinha, 2007). The Ganga River basin along with its different tributaries is a magnificent example of a floodplain region with numerous geomorphic features in a foreland basin (Jain & Tandon, 2010; Singh, 1996; Tandon & Sinha, 2007). Due to the high agriculture and urbanization, with surface and groundwater systems, the basin is well known globally for its potential at variable scales for ecological, economic, and social aspects. When paired with geomorphological information, the palynofacies (particulate organic matter) is an effective analytical tool that is used to evaluate the depositional environment and the

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