

ABOUT THE STUDY AREA

3.1 The Ganga Plains

The Gangetic Plain is one of the most extensive floodplains in the world (Singh, 1996) which is bounded in the south by the Vindhyan highlands of Proterozoic times and in the north by the young Himalayan folded mountain chain of Cenozoic, formed due to the collision between the Indian and Tibetan-China plates. It is formed by the numerous rivers, which originate from the Himalayas in the north and the Indian craton in the south (Fig. 3.1). The Ganga River is the main stream of the Ganga basin with a total axial length of 2510 km with a catchment area of 980, 000 km² (Khanolkar et al., 2020). The thickness of the alluviums of the Indo-Gangetic plains continuously increases from the south to the north, i.e., towards the Himalayas (Singh 1996; Srivastava et al., 2003). Rivers draining the Ganga basin have been categorised into three types based on their source, viz. mountain-fed, foothills-fed and plains-fed (Sinha and Friend, 1994). The Ganga Plain is full of diverse and complex hydro-geomorphological landscapes, i.e., active/inactive channels, floodplains, riverine wetlands, agricultural lands, etc. (Singh, 1996). The major factors responsible for developing these geomorphic features are tectonic activity, climatological conditions, and geomorphological factors in the past (Jain and Sinha, 2005). The sedimentary deposits found in the Gangetic plain, predominantly consisting of sand and sandy clay, are categorised into banger (older alluvium) and khadar (younger alluvium). Within the interfluvial zone, the sediment deposits are part of the older alluvium (Krishnan, 1960; Rao, 1973).

3.2 Study Area: The Interfluvial Zone of the Ganga and Sai Rivers

3.2.1 Location

The study area is part of the Gangetic plains and lies in the interfluvial region of the Ganga River (in the south) and the Sai River (in the north). It is situated in Uttar Pradesh, India, and extends from Unnao district (north-west) through Raebareli to Pratapgarh district (south-east), within the geographical coordinate 25°39' to 26°55' N

About the Study Area

& longitude 80°20' to 82°01' E (Fig. 3.1). The elevation in this area varies from 90 to 125 m. In the northern part of the study area, the regional slope trends in the SSE direction, gradually shifting towards the S.E. direction in the southern part. The average length of the study area is about 235 km, with an aerial extent of about 9588 km².

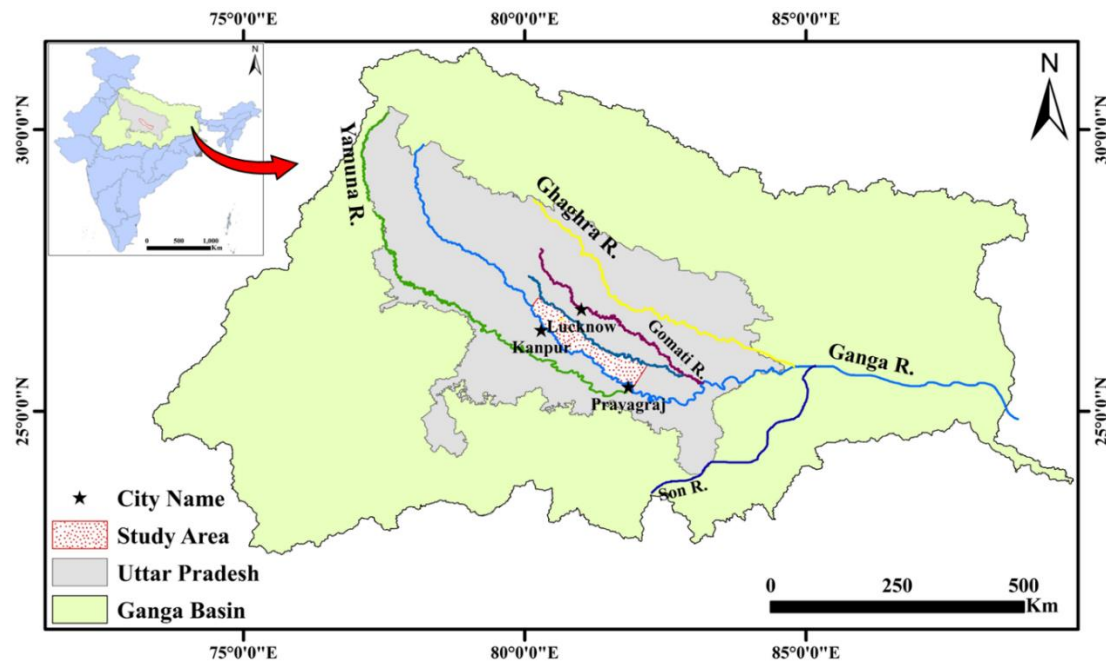


Fig. 3.1 The location of the study area shown by crosshatch lies in the interfluvial zone of the Ganga and Sai Rivers, Uttar Pradesh.

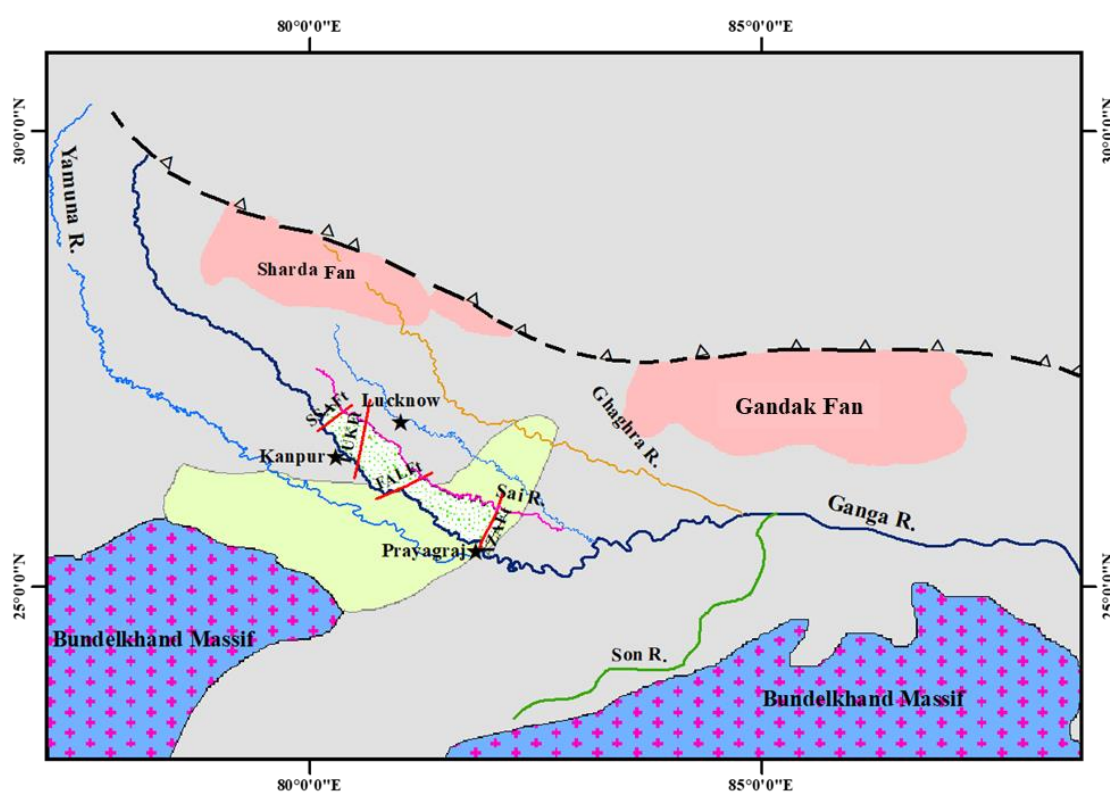
3.2.2 Climatic Conditions

The study area lies in the sub-tropical humid climatic conditions. The average annual rainfall is 794mm. The mean average temperature varies from 20°C to 32°C, while a maximum of 45°C temperature is reached in the month of June during the summer (Source: "Annual Report- 2022, India Meteorological Department (IMD), Pune, India).

3.2.3 Geology

The interfluvial zone is a section of the Ganga plain primarily composed of alluvium, which are Quaternary sediments comprising clays, silt, kankar, and sands of various grades. The thickness of these alluvial deposits consistently increases from the southern region towards the northern part, nearing the Himalayas (Singh 1996; Srivastava et al., 2003). The Quaternary sediments found in the study area were

723 deposited under fluvial conditions. The alluvial deposits from the Quaternary age
 724 (middle Pleistocene to Recent) rest on the Proterozoic sedimentary rocks of the
 725 Vindhyan basin, forming the basement for these sediments. Within the Gangetic Plain,
 726 the alluvium deposits are categorised into banger (older alluvium) and khadar (younger
 727 alluvium). The sedimentary deposits in the interfluvial zone belong to the older
 728 alluvium (Krishnan 1960; Rao 1973; Chaudhary et al., 2021). The interfluvial zone is
 729 referred to as the T2 surface (Singh 1996). The basement is very much affected by neo-
 730 tectonic activity, which largely controls the courses and thickness of the alluvial rivers
 731 (Sastri et al., 1971; Ramachandra and MB 1973; Singh 1996; Singh et al., 2006; Shukla
 732 2016) (Fig. 3.2). According to Singh et al. (2006), five faults have been identified in the
 733 interfluvial zone of the Ganga and Sai Rivers, i.e., Sidhaur–Sandila Fault (SSAFt),
 734 Lucknow Fault (LUKFt), Sitapur–Shahjahanpur Fault (SSHf), Faizabad–Lalganj
 735 Fault (FALFt), and Azamgarh–Allahabad Fault (AZAFt).



736
 737 **Fig. 3.2** Geological and geomorphic map of the study area (after, Sastri et al. 1971; Rao
 738 1973; Singh 1996; Singh 2004). The map shows the geological set-up in reference to
 739 lineaments/faults and geological formations. A white-coloured dotted portion in the
 740 interfluvial zone of the Ganga and Sai Rivers denotes the study area. The faults in the
 741 study area are marked by red coloured lines (SSAFt = Sidhaur–Sandila Fault; LUKFt =
 742 Lucknow Fault; FALFt = Faizabad–Lalganj Fault; AZAFt = Azamgarh–Allahabad
 743 Fault;) (Singh et al. 2006).

3.2.4 Geomorphology

The study area exhibits a series of paleochannels in the form of several underfit rivers, remnants of ancient river channels, meander scars, and ox-bow lakes which indicating the preservation of ancient river courses. These hydrogeomorphic features are located in the upper and lower reaches of presently existing prominent channels (channel filled with water whole year), or an ephemeral river named as the Bakulahi River. The sediments in this region have a fine-grained nature and were deposited under different depositional conditions compared to the deposits of the major rivers surrounding the area (Kumar et al. 1995; Singh 1996; Singh et al. 1999). The region experiences minimal influence from the ongoing processes at its northern boundary (Sai River) and southern boundary (Ganga River). The formation and features of the wetlands in this belt are distinct. Among the 49 Ramsar sites in India (2021), the study area encompasses two Ramsar sites: (i) Samaspur Bird Sanctuary and (ii) Nawabganj Bird Sanctuary (Shahid Chandra Shekhar Azad Bird Sanctuary) (Fig. 3.3).

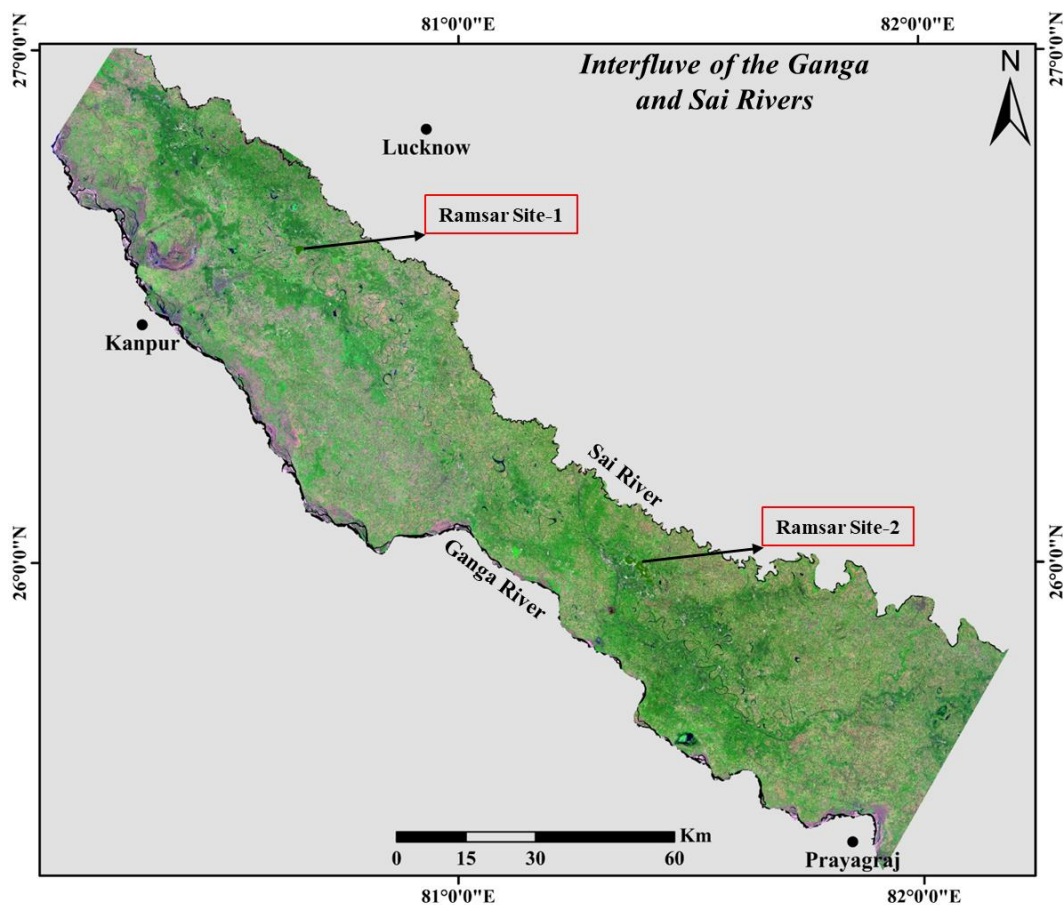


Fig. 3.3 The interfluvial zone of the Ganga and Sai Rivers. Arrow showing the Ramsar wetland.

761 **3.2.5 Land-Use and Land-Cover (LULC)**

762 The highly fertile interfluvial zone is mainly occupied by agricultural land,
763 although some part in the form of patches is affected by salt. Three major crops, i.e.,
764 Kharif, Rabi, and Zaid, can be identified during June-September, October/November-
765 March and March-June, respectively.

766 **3.3 Field Visit**

767 Field visits were done after the detailed observation of the study area in satellite
768 images. The main objectives of the field visit were resistivity surveys and sediment
769 sampling. Some photographs of the field visit are:

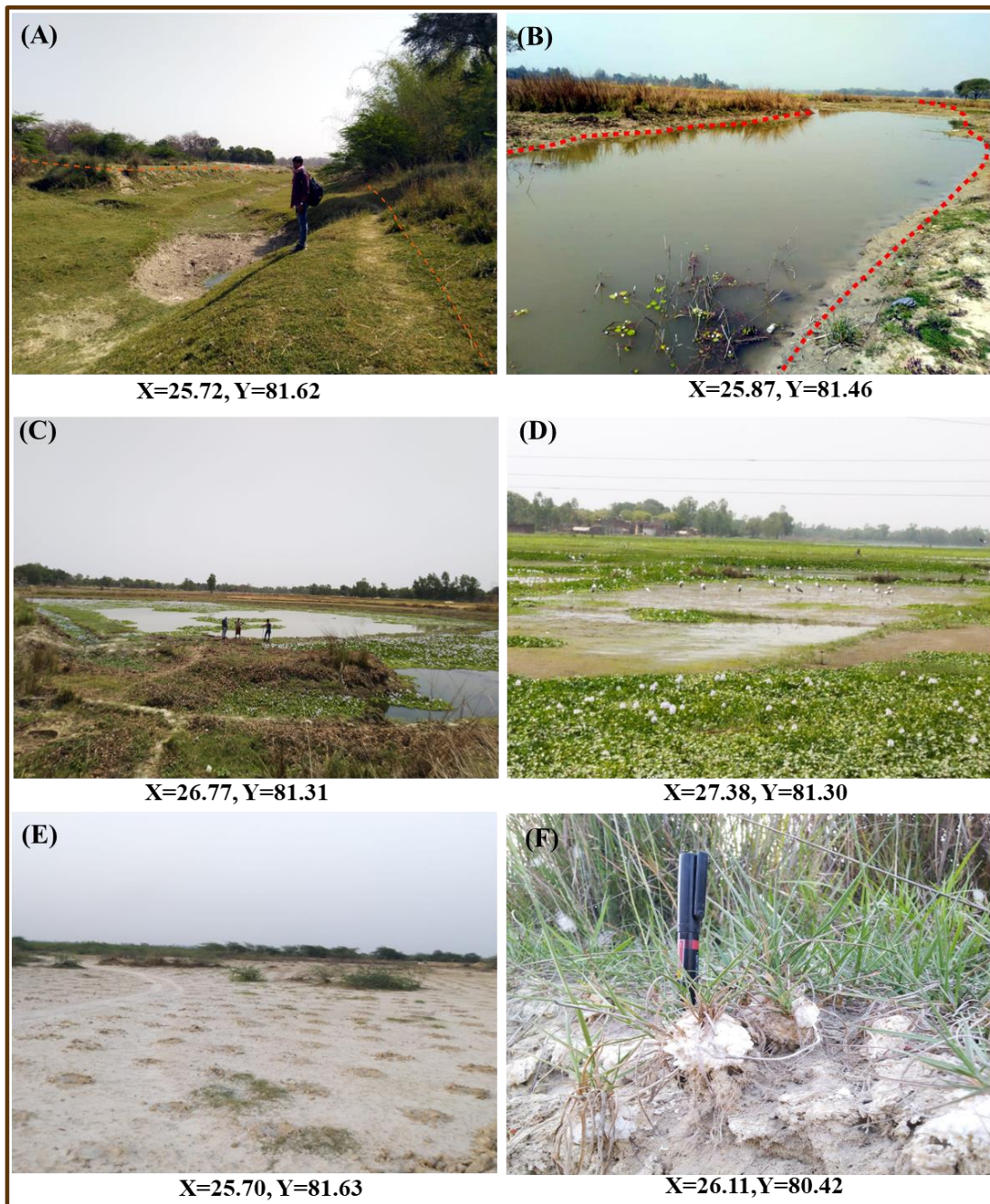


Fig. 3.4 (A) and (B) Show the paleochannel and prominent channels respectively, (C) and (D) photograph of the riverine wetlands, (E) deposition of salt in the soil in the form of white patches and (F) Deposition of salt in the root of plants. X and Y = latitude and longitude.