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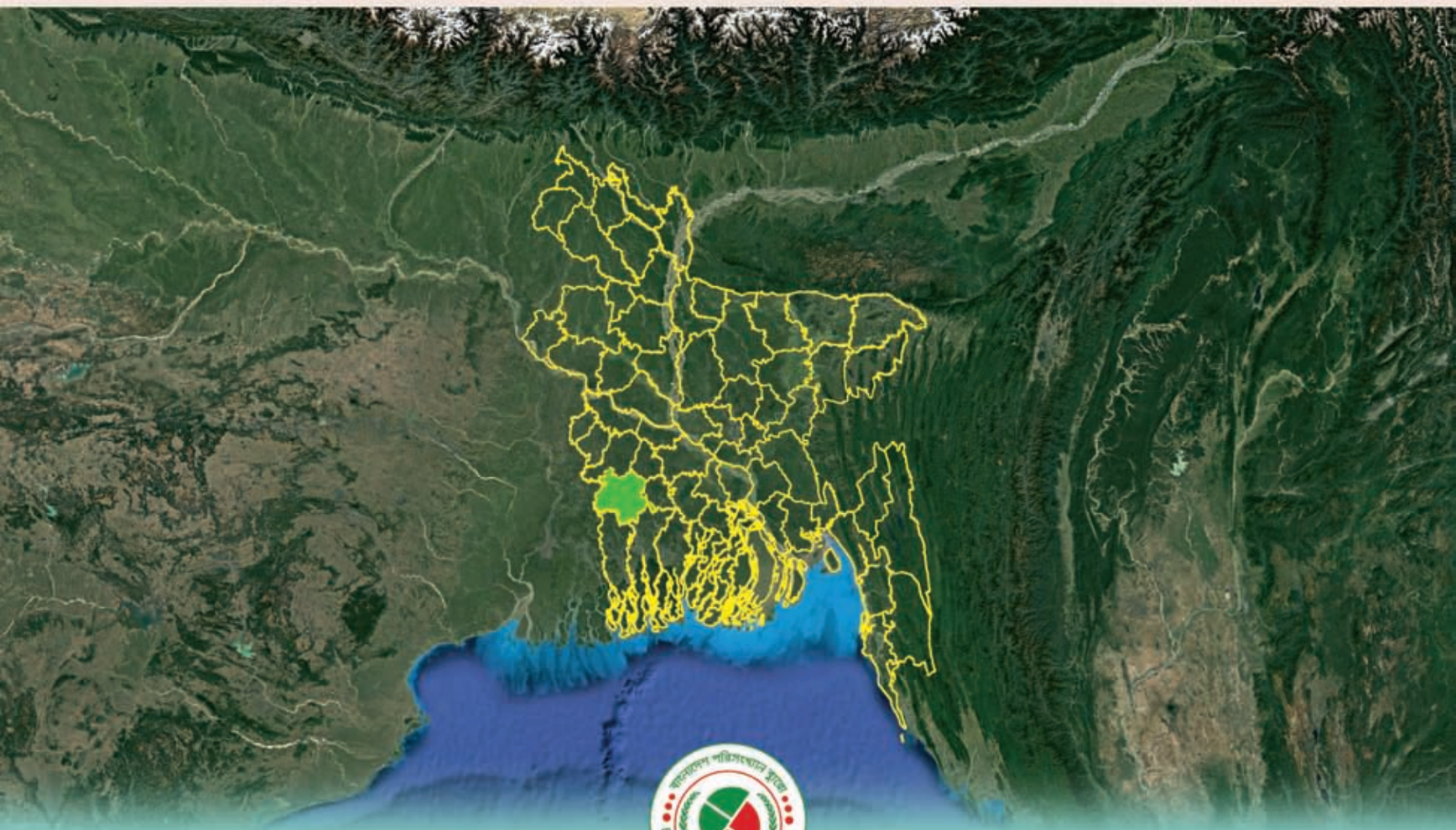
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

DISASTER PRONE AREA ATLAS BANGLADESH

JASHORE ZILA



BANGLADESH BUREAU OF STATISTICS (BBS)
STATISTICS AND INFORMATICS DIVISION (SID)
MINISTRY OF PLANNING

Cover (Front)

Map of Bangladesh highlighting the concerned District

Cover (Back)

Stat4Dev Project

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Foreword

Bangladesh Bureau of Statistics (BBS), the National Statistical Organization (NSO) of the country, is responsible for collecting, compiling and disseminating statistics on population, demography, and economics as well as on other social indicators to measure the trends of the country's growth and development. Conducting Population and Housing Census is one of the core activities of BBS. Beside this, BBS conducts a lot of inter-censual surveys and generates analytical reports for the users which are mainly used for planning and policy-making at the national and sub-national levels. These reports are widely used for poverty alleviation interventions and initiatives for the improvement of the people's quality of life.

Bangladesh has taken a holistic approach towards disaster management, where emphasis has been given for working together with all stakeholders to build strategic, scientific and implementation partnerships with all relevant government departments and agencies, other key non-government players including NGOs, academics and technical institutions, the private sector and development partners. The role of the Government is mainly to ensure the risk reduction and comprehensive disaster management program. Giving emphasis on that, BBS took an initiative to produce disaster prone area atlas for 15 coastal districts of the country. These atlases will focus on the existing situation of hazards, risk and disaster proneness of the districts and at the same time it will help visualise the vulnerability through map and statistics. The disaster prone Atlas of Jashore District is one of the outputs of such an initiative.

However, let me take the privilege to thank UNFPA for providing financial and technical support to the Stat4Dev Project of BBS under which this atlas is prepared. I would like to thank the working group comprising experts from the Government of Bangladesh, Research Organizations and International Organizations for their technical backstopping in preparing the maps and the Atlas. I also would like to express my sincere thanks to the Director General of BBS, Project Director, Stat4Dev project and his team for their sincere efforts in successful completion of this tremendous job. Thanks are also due to the distinguished members of the Technical Committee and Report Review Committee for their valuable guidance in finalizing the Atlas.

Dhaka: November, 2021

Dr. Shahnaz Arefin, ***ndc***

Director General
Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning
Government of the People's Republic of Bangladesh

Preface

Bangladesh Bureau of Statistics (BBS) has already entered into a new era through the enactment of *The Statistics Act, 2013*. As per this Act, BBS is mandated as the standalone agency for generating official statistics. The law has empowered BBS to provide guidance to other agencies for producing official authenticate statistics generated by them. The Act also has given responsibility to BBS for prepare Integrated Geographical Information System (GIS) to foster integration of GIS with statistics. According to *The Statistics Act 2013*, BBS has prepared the National Strategy for Development of Statistics (NSDS) aimed at capacity building of the nationwide use of statistics with a special focus on Environment, Climate Change and Disaster related quality statistics. Following the mandate, previously BBS published small area atlas for 64 districts in 2014-2017. Now BBS is going to prepare the disaster prone area atlas for 19 coastal districts of the country for the first time. The disaster prone area atlas of Bangladesh is a tool to enhance decision-making for reducing the economic and social impacts of natural disaster in the country. It is intended to provide a wide range policymakers with appropriate risk information in order to strengthen the capacity of the country to develop disaster risk reduction and management. It provides tool in identifying, showcasing and disseminating information to make sound decisions to enhance the planning and development process. The atlas serves as a catalyst for the holistic approach of building resilient communities. The disaster prone area atlas of Jashore District is one of the outcomes of our disaster prone area mapping exercise.

I am grateful to UNFPA for their technical and financial assistance and to the representatives of universities; research organizations for their valuable guidance in preparing the atlas, My sincere thanks are also due to Mr. Md. Akther Hossain, Project Director, Mr. Md. Abubakar Siddique, Cartographer and other colleagues of Stat4Dev Project of BBS for their relentless effort in preparing the atlas and for bringing out this atlas. The members of the Editorial Committee deserve special thanks for their input in the technical improvement of the atlas.

I think this atlas will be useful to the policymakers, researchers and development partners to meet their demand for mapping the country. Any constructive suggestion for further improvement of this report will be highly appreciated.

Dhaka: November, 2021

Mohammad Tajul Islam

Representative a.i.
UNFPA Bangladesh

Message

Climate change is the greatest challenge facing humanity today. Due to its geographical location and climatic conditions, Bangladesh is particularly vulnerable to the effects of climate change. Floods and other climate change induced natural calamities have become more frequent in the country in the past decades, which poses a serious threat to the country's sustainable development and the future prospects of already vulnerable communities.

To make local communities more resilient in the face of these emerging challenges, UNFPA is working in partnership with the Government and its development partners to gain a better understanding of the linkages between population dynamics and climate change in Bangladesh. Through robust data collection and knowledge management practices, our aim is to integrate knowledge on population dynamics into national planning and monitoring systems to address climate change. In line with the principle of "leave no one behind" that underlies the 2030 Agenda for Sustainable Development, we particularly wish to redress inequalities as a matter of human rights and ensure that everyone in Bangladesh receives protection and assistance in emergencies, regardless of their sex, age or location.

This Disaster-Prone Area ATLAS published by the Bangladesh Bureau of Statistics (BBS) under the Statistics and Informatics Division (SID) of the Ministry of Planning, is a shining example of the results of our productive partnership so far. The document provides a comprehensive overview of the spatial and temporal occurrences of natural calamities, as well as the geophysical and socio-economic characteristics of various districts across Bangladesh. I am certain that it will prove to be an immensely useful tool for us, as we allocate resources and devise mitigation strategies and preparedness plans for disaster response in Bangladesh throughout the coming years.

On behalf of UNFPA, I would like to express my sincerest appreciation to the Secretary of SID, Dr. Shahanaz Arefin; the Director General of BBS, Mohammed Tajul Islam; the Project Director of the Stat4Dev project, Md. Akhter Hossain; and the entire team at BBS for their immense efforts in completing this ATLAS despite the challenges posed by the ongoing COVID-19 pandemic. It has been our honour to support you in completing this vital task.

Dhaka: November, 2021

Eiko Narita

Project Director
Stat4Dev Project
Bangladesh Bureau of Statistics (BBS)
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Ministry of Planning

Acknowledgement

I am delighted to acknowledge the active role of officials concerned in undertaking the exercise for preparation of the Disaster Prone Area Atlas. It is worth-mentioning that the staff members of BBS have professionally and successfully completed the Atlas by overcoming all the challenges.

I would like to express my humble gratitude and thanks to Dr. Shahnaz Arefin, ndc, Secretary, Statistics and Informatics Division (SID), Mr. Mohammad Tajul Islam, Director General, Bangladesh Bureau of Statistics, Mr. Shaikh Md. Kabedul Islam, Additional Secretary (Informatics), Statistics and Informatics Division (SID), Ms Mahmuda Akhter, Ex. Additional Secretary (Informatics), Statistics and Informatics Division (SID), Mr. Ghose Subobrata, Ex.Deputy Director General, Bangladesh Bureau of Statistics for their valuable suggestions, patient guidance, and all-out support for completion of the disaster prone area atlas.

Thanks are also due to UNFPA Bangladesh for their generous support to BBS for conducting National Population Census and other outputs, like preparing disaster prone area maps using the census data for the very meaningful use by different government and non-government agencies.

I am particularly grateful to Mr. Md. Abubakar Siddique, Cartographer, Stat4Dev Project of BBS and the distinguished members of the Technical Committee and the Report Review Committee who were the active members of this Atlas team.

I have the pleasure to express my deepest gratitude to Mr. Rezaul Roni, Associate Professor, Department of Geography and Environment, Jahangirnagar University and Mr. Md. Maksud Hossain, Ex. Deputy Director, Bangladesh Bureau of Statistics who gave their full effort in preparing this Atlas. My great appreciation is due to the members of the Project Management Team of stat4Dev project for their relentless efforts in this exercise.

I am deeply indebted to various stakeholders and agencies concerned who always provided their valuable suggestions and comments for the successful completion of the Atlas and data collection from field.

Hopefully, users and readers will continue to forward their suggestion and comments for further improvement of this report.

Dhaka: November, 2021

Md. Akther Hossain

Acronyms

ADPC	Asian Disaster Preparedness Center
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
DRR	Disaster Risk Reduction
GIS	Geographic Information System
MoL	Ministry of Land
NGO	Non-governmental Organization
NSDS	National Strategy for Development of Statistics
SoB	Survey of Bangladesh
SWIR	Short Wave Infrared
UN	United Nations
WHO	World Health Organization

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Chapter 1

Introduction

1.1 Background

Bangladesh is broadly distinguished as one of the most susceptible countries of the world to climate change. In addition, it is one of the most vulnerable countries of the world in terms of natural and anthropogenic hazards. As per the World Risk Report 2015, Bangladesh has been identified as the sixth most natural disaster-prone country among 173 countries in the world. The geography and climate have made the country vulnerable to different meteorological, hydrological and geological hazards. Natural hazards are a direct result of increased rainfall in the monsoon season, rising sea levels from climate change, and tropical cyclones. The occurrences of natural disasters in the nation are supposed to increase because of climate change. Each disaster brings about devastating effects on the nation's agriculture, water supply, food resources, health and shelter. It is predicted that the effects of climate change, in the future, will generate more than 20 million climate refugees. Bangladesh is among the countries most predisposed to extensive flooding, tornados and destructive cyclones. Additionally, the water in Bangladesh is frequently contaminated with arsenic due to flooding and the high arsenic contents in the soil. It is estimated that nearly 77 million people in Bangladesh are exposed to toxic arsenic from drinking water (WHO, 2000).

Bangladesh Bureau of Statistics (BBS) has already been entered into a new era through the enactment of the Statistical Act 2013. As per the Act, BBS is mandated as the stand-alone agency for generating official statistics. The law has empowered BBS to guide other agencies for producing official statistics and also to authenticate statistics generated by them. Consequently, BBS has prepared the National Strategy for Development of Statistics (NSDS) aiming at capacity building of the nationwide use of statistics as well as Environment, Climate Change and Disaster-related quality statistics.

1.2 Objectives

As a consequence of the above NSDS, BBS is going to prepare 15 coastal districts disaster-prone area atlas based on field verification and updating GIS map with other related information. Each disaster-prone area atlas will represent a single district and existing situations of hazard and risk are visualized through maps and statistics.

1.3 Scope of the work

Geographically, the survey was conducted to the entire areas of the selected 15 coastal districts. A mauza/ mahallah list containing the dominant disaster information for all the 15 districts were created to prepare the risk map. The risk analysis was done at the extent of both the national and local levels. It will focus on the main disaster namely flood, salinity, storm surge, excess rainfall, cyclone, thunderstorm and windstorm.

1.4 About the national disaster atlas

The main deliverable of the project is the district-specific disaster-prone area atlas. The atlas contains general information about the demographic and climatic characteristics of a specific district. It describes the main elements at risk and the hazard profile of the local level based on settlements. The information was collected from the local level community and

compiled to construct the maps. It contains an analysis of the risk and vulnerability of the district. The disaster-prone area atlas of Bangladesh is a tool to enhance decision-making to reduce the economic and social impacts of natural hazards in the country. It is intended to provide a wide range for decision-makers and policymakers with appropriate risk information to strengthen the capacity of the country to develop strategic risk management strategies. It provides an excellent tool in identifying, showcasing and disseminating important information needed to make timely and sound technical decisions to enhance the development process. The atlas catalyzes the holistic approach of building resilient communities.

1.5 Expected benefits to the nation

At the end of this Atlas, a lot of information on disaster and risks will be available as well as be able to define the disaster profile of specific districts of Bangladesh. Such a disaster risk profile will help to better coordinate all disaster management related initiatives proactively at national and local levels, leading to the reduction of disaster risk for all.

1.6 Key stakeholders

The National Disaster Atlas is intended to benefit a range of stakeholders and potential users. Mainly, the key decision/policy-makers will be able to ensure policymaking and decisions are based on robust risk information. The atlas will benefit donors and development partners by informing them of their respective project formulation and design and risk-proofing development interventions. It will also ensure risk-informed planning by planners in the government institutions, non-governmental organizations and the private sector. Besides, the academe is one of the expected beneficiaries and users of the atlas specifically as a basis or reference for further researches and academic papers. Moreover, the private sector will also benefit from the atlas as its findings could guide them in disaster risk proofing their investments. The humanitarian actors could also utilize the atlas as a guide in identifying hazard-safe areas where humanitarian interventions are placed and implemented. The districts and the local communities will by and large be the main beneficiaries and users of the atlas.

As herein listed, these stakeholders were grouped into ministries, governmental institutions, regional organizations, and international organizations including UN Agencies and NGOs. Some of the other stakeholders, particularly the regional organizations, participated in the project by providing data required in the assessment including thematic inputs in the use of software, and modeling, including the development of the methodology and analysis.

1.7 Key concepts and definitions

Disaster.

According to the *Disaster Management Act, 2012*, 'Disaster' means any such incidents mentioned below created by nature or human or created due to climate change and its massiveness and devastation cause such damage to cattle, birds and fisheries including life, livelihood, normal life, resources, assets of community and the environment of the damaged area or create such level of hassle to that community whose own resources, capability and efficiency is not sufficient to deal this and relief and any kind of assistance is needed to deal that situation, such as: - (a) Cyclone, northwester, tornado, sea high tides, abnormal tides, earthquake, tsunami, excessive rains, shortfall of rains, flood, erosion of river, erosion of coastal area, drought, excessive salinity, excessive pollution of arsenic, building slide, landslide, hill slide, gushing water from hills, hailstorm, heat wave, cold wave, long term water logging etc.; (b) Explosion, fire, capsize of vessel, massive train and road accident, chemical and nuclear radiation, pilferage of oil or gas, or any mass destruction incident; (c) Disease causing pandemic, such as pandemic influenza, bird flue, anthrax, diarrhea, cholera, etc.; (d) Harmful microorganism, poisonous materials and infection of life active object including infection by bio based or biological infectious object; (e) Ineffectiveness or damage of essential service or disaster protection infrastructure; and (f) Any unnatural incident or a misfortune causing massive life loss and damage.

Disaster risk

The potential disaster losses in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time. The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses, which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least.

Disaster risk reduction

Disaster Risk Reduction (DRR) is the development and application of policies and practices that minimize risks to vulnerabilities and disasters, applies to manage and /or responding to current disaster risks.

Early warning system

It is a major element of disaster risk reduction. It prevents the loss of life and reduces the economic and material impact of disasters. To be effective, early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate alerts and warnings and ensure the constant state of preparedness (Ibid).

Exposure

People, property, systems, or other elements present in hazard zones that are thereby subjected to potential losses. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

Hazard

'Hazard' means any unnatural incident which is created by natural law, due to technical faults or by humans and as a result brings down the normal lifestyle of people into danger and risk through occurring devastation and create sorrows and sufferings including devastating and irreparable damages to necessary items to maintain livelihood (*The Disaster Management Act, 2012*).

Natural hazard

Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Natural hazards are a sub-set of all hazards. The term is used to describe actual hazard events as well as the latent hazard conditions that may give rise to future events. Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration, and area of extent. For example, earthquakes have short durations and usually affect a relatively small region, whereas droughts are slow to develop and fade away and often affect large regions. In some cases, hazards may be coupled, as in the flood caused by a hurricane or the tsunami that is created by an earthquake.

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. The resilience of a community concerning potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both before and during times of need.

Return period

A return period, also known as a recurrence interval or repeat interval, is an estimate of the likelihood of an event to occur. It is a statistical measurement typically based on historical data denoting the average recurrence interval over an extended period. The theoretical period is the inverse of the probability that the event will be exceeded in any other year. For example, a 25-year flood has a 1/25 = 0.25 or 25% chance of being exceeded in any one year. Despite the

connotations of the name "return period", it does not mean that a 25-year flood will happen regularly every 25 years or only once in 25 years *(Wikipedia, 2015)*.

Risk

Risk means hazards, factors of dangers and the possible harmful situation created due to the internal process of the environment or assembling and capability. *(The Disaster Management Act, 2012)*

Risk analysis

The process to comprehend the nature of risk and to determine the level of risk (ISO 31010).

Risk assessment

A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. Risk assessments (and associated risk mapping) include a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical, social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.

Vulnerability

Vulnerability means any such existing socio-economic, geographical and environmental condition of any community, which may make the expected capability of the community vulnerable, weak, unskilled and limited to adapt to the effect of natural or human-created hazard or any adverse reaction *(The Disaster Management Act, 2012)*.

Natural disaster

A natural disaster is a major adverse event resulting from natural processes of the earth; examples include cyclones, drought, floods, erosion, volcanic eruptions, earthquakes, tsunamis, and other geologic processes. A natural disaster can cause loss of life or property loss and damages, and typically leaves some economic loss and damages, the severity of which depends on the affected population's resilience, or ability to recover.

Drought

Bangladesh faces unpredictable drought hazard in the dry monsoon due to inadequate and uneven rainfall. It varies from place to place, however, and the north western region of Bangladesh suffers most from the drought almost regularly in a two-year cycle. It is unusual dryness of the soil, resulting in crop failure and shortage of water for other usage, caused by significantly lower rainfall than average over a prolonged period. Hot dry winds, shortage of water, high temperature and consequent evaporation of moisture from the ground can contribute to conditions of drought. This may have initiated the process of desertification in those districts where the affected areas maintain high temperatures, non-availability of surface water due to drying out of water sources, crops die out and there is a crisis of fodder as well. For people who are directly dependent on rainwater, drought is a big problem (Disaster Related Statistics, BBS, 2015).

Flood

Flood is one of the major natural disasters in Bangladesh. In general, the normal inundation of flood-free areas by water caused by excessive rain and spillage from the overflown river banks is called a flood. Floods bring about immense havoc to the lives of the people. Flooding is a natural phenomenon in Bangladesh and occurs on an annual basis. The rivers are huge by global standards and can inundate over 30% of the landmass at a time. Bangladesh is prone to serious and chronic flooding. Even in an average year, 18% of the landmass is inundated and previous floods have affected 75% of the country (as in 1988). 75% of the country is below 10m above sea level and 80% is classified as floodplain as Bangladesh is principally the delta region of South Asia's great rivers. Bangladesh floods regularly, recent notable and catastrophic floods have occurred in 1988, 2004, 2007 and 2010. Floods cause erosion of chars (islands) by flooding rivers, cause landlessness amongst Bangladesh's poor; environmental refugees, loss of property, lives, epidemic, other water-borne diseases, lack of drinking water, loss of agricultural land and crops, communication disruption are some of the major effects of this natural disaster (Disaster Related Statistics, BBS, 2015).

Water logging

Bangladesh's high vulnerability to frequently occurring natural disasters is known worldwide, a lesser-known new phenomenon - water logging - has been disrupting the livelihoods of people during the past two decades. The phenomenon involves the deterioration of drainage conditions in several southern coastal rivers leading to temporary to permanent inundation of floodplains along those rivers, causing enormous difficulties towards maintaining livelihoods and disrupting land-based productive systems including crops. The problem has become severe in the southwestern parts of Bangladesh, especially along the Kapotaksha (Kobadak) river system covering parts of Jashore, Khulna and Satkhira districts. Waterlogging is also becoming an issue in the central southern Noakhali district, where gradual chocking of the Noakhali river (i.e., khal) has given rise to temporary water logging every year (Disaster Related Statistics, BBS, 2015).

Cyclone

A large-scale closed circulation system in the atmosphere with low barometric pressure and strong winds that rotate counter clockwise in the northern hemisphere and clockwise in the southern hemisphere. The system is referred to as a cyclone in the Indian Ocean and South Pacific, hurricane in the western Atlantic and eastern Pacific and typhoon in the western Pacific. Cyclones are the most devastating of natural disasters. Generally, the disasters faced by the coastal areas are related to tides, river flows and weather conditions leading to cyclonic winds. A major hazard that occurs in the coastal areas is mostly due to weather conditions associated with depressions of varying severity. The hazards due to cyclones are associated with elements such as depressions, cyclone surges, the effect of wind speed, hazard areas, etc. High winds cause rough conditions and high waves during the time of depression over the sea and cause damage and loss throughout the land they pass over. In Bangladesh, the main cause of damage and loss is the severe cyclonic storm with hurricane intensity. In Bangladesh, most of the cyclones occur during the pre-monsoon (April/ May/ early-June) and post-monsoon (late-September/ October/ November) period. The pre-monsoon period is the sowing or broadcasting season for 'Aus' rice and the post-monsoon season is the harvesting season for 'Aman' rice in the coastal areas. Hence, the impact of cyclones is severe in terms of economic loss, as well as the loss of lives and property (Disaster Related Statistics, BBS, 2015).

Tornado

The two transitional periods between southwest and northeast monsoons over the Indian Sub-continent are characterized by local severe storms. The transitional periods are usually referred to as pre-monsoon (March-May), and post-monsoon (October-November). It is the pre-monsoon period when most of the abnormal rainfall or drought conditions frequently occur in different parts of Bangladesh. Also, there are severe local seasonal storms, popularly known as nor'westers (Kalbaishakhi). Severe nor'westers are generally associated with tornadoes. Tornadoes are embedded with in a mother's thundercloud and move along the direction of the squall of the mother storm. The frequency of devastating nor'westers usually reaches the maximum in April, while a few occur in May and the minimum in March. Nor'westers and tornadoes are more frequent in the afternoon (Disaster Related Statistics, 2015).

Storm/Tidal surge

Storms are caused by atmospheric disturbance involving perturbations of the prevailing pressure and wind fields, on scales ranging from tornadoes (1 km across) to extra-tropical cyclones (2000-3000 km across). This causes a rise in sea level that result in the inundation of areas along coastlines. The movement of ocean and sea currents, winds and major storms causes these phenomena (Disaster Related Statistics, 2015).

Thunderstorm

A thunderstorm, also known as an electrical storm, a lightning storm, or a thundershower, is a type of storm characterized by the presence of lightning and its acoustic effect on the earth's atmosphere known as thunder. Thunderstorms occur in

association with a type of cloud known as a cumulonimbus. They are usually accompanied by strong winds, heavy rain and sometimes hail, or, in contrast, no precipitation at all. Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of over 20 km (12.45 miles). As the rising air reaches its dew point, water droplets and ice form and begins to fall through the clouds towards the earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of cold air and moisture that spreads out at the earth's surface, causing the strong winds commonly associated with thunderstorms, and occasional fog (Disaster Related Statistics, 2015).

River/Coastal erosion

A combination of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the earth's surface. The energy in a river causes erosion. The bed and banks can be eroded making it wider, deeper and longer. River erosion and submerging of the coastal lands are the natural phenomena being one of the main natural disasters. River and coastal erosion cause much more destruction to the socio-economic mechanism than any other natural disaster. Loss of life may not happen due to erosion but it makes people undone. It causes massive financial loss and damages. The immense pressure of the downwards tide, current force and twirl, waves and tides, storm, tidal surges, lack of trees on the riverbank causes erosion to the coastal islands every year. The collision between downwards current of freshwater and uprising sea level creates strong twirling that causes erosion to the coast. Moreover, due to combined sudden flood, heavy rain, and downwards freshwaters causes a collision to the riverbank and cause erosion to the riverbanks and coastal areas. Deforestation and lack of plantation in the riverbanks and coastal areas are also complemented by riverbank and coastal erosion (Disaster Related Statistics, 2015).

Landslide

Landslides are a complex-disaster phenomenon that can be caused by earthquakes, volcanic eruptions, heavy rainfall (typhoons, hurricanes), sustained rainfall, heavy snowmelt, unregulated anthropogenic developments, mining, and others. In Bangladesh, landslides are mostly triggered by heavy rainfall. However, underlying causes of landslide include deforestation, hill cutting, unregulated development work, etc. Moreover, poverty and landlessness force poor people to live in risky hill-slopes. However, recently landslide has emerged as a major hazard, particularly after the Chattogram Landslide 2007. Due to heavy rainfall from 10 -11 June 2007, landslides and collapsed walls caused widespread damages in six areas of Chattogram city and different Upazilas of the District (Disaster Related Statistics, 2015).

Salinity

Saline water intrusion is mostly seasonal in Bangladesh; in winter months, the saline front begins to penetrate inland, and the affected areas rise sharply from 10 percent in the monsoon to over 40 percent in the dry season. Coastal districts such as Satkhira, Khulna, Bagerhat, Barguna, Patuakhali and Barishal are the victims of salinity intrusion. Agricultural

production, fisheries, livestock, and mangrove forests are affected by higher salinity in the dry season. It is observed that the dry flow trend has declined as a result of which sea flow (saline water) is traveling far inside the country resulting in contamination both in surface and ground water. The population of pure freshwater fish species decline and species that are more tolerant survive and dominate changing the composition of the ecosystem and affecting the livelihoods of the people dependent on the freshwater resources (Disaster Related Statistics, 2015).

Hailstorm

Hailstorm is a very curious geographical and climatic phenomenon. A hailstorm is named such, because during the storm, hail or balls of ice fall in huge quantities on the earth. It is nothing but irregular lumps or balls of ice. The specialty of a hailstorm is that both hail, i.e. balls of ice, and rainwater fall during the storm, at the same time. The hailstorms are not exactly storms but are a side effect of a much bigger storm, the thunderstorm. This phenomenon originates from thunderclouds that are known as Cumulonimbus clouds. When the existing temperature of a mass of air currents falls rapidly over decreasing altitude, it results in a hailstorm. The hailstones are formed due to the process of freezing and grow over time. They are carried by the updrafts or the air currents moving in the upward direction until they become large for these currents to continue carrying them. Hailstones must have at least 3/4 inch of diameter to become severe and cause a substantial amount of damage and loss to life and property. Being a nature's phenomenon and a type of natural disaster, hailstorms are unavoidable. The impact of hailstones can cause widespread damage and loss to vulnerable plants, crops, infrastructure and equipment that is stored outside. Hailstones have the potential to destroy animals, plants and human life upon impact if strong enough (Disaster Related Statistics, 2015).

1.8 Data and Map Sources

The development of a comprehensive disaster risk profile requires foremost a good understanding of the general context and background of the country. Accordingly, a wide range of data has been collected. These data were organized in a dataset and converted into GIS formats. The data include administrative entities, population, infrastructure, buildings and settlement, livelihood, health, education, elevation and topography and land use countrywide. It is important to note that the data availability constitutes a main challenge and constraint for the preparation of this Atlas. The following table contains the sources of data, their content along with type and format.

Table 1.1: Database Inventory

S/N	Type of data	Format	Content	Source
1	Topographic Maps	Image	Images covering the specific area produced in 2010	SoB
2	Land Cover Map	GIS Shapefiles	Land use land cover information	MoL
3	Education facilities location	GPS locations	Specific locations and other related information	BBS
4	Health facilities location	GPS locations	Specific locations and other related information	BBS
5	Administrative boundary	GIS Shapefiles	Administrative boundary with Geocode	BBS
6	River Network	GIS Shapefiles	Detailed river network with the name	BWDW
7	Meteorological data	Spreadsheet	Daily Temperature, Rainfall, Humidity with station location's latitude and longitude	BMD
8	Demographic data	Spreadsheet	Mauza specific various demographic related data	BBS
9	Soil salinity	Point-based GIS Shapefiles	Salinity measurement for the specific location of the study area	BARC
10	Disaster information	Spreadsheets	Various disaster and related damage information	BBS

Chapter 2

Methodological Framework for Hazard and Risk Assessment

2.1 Understanding country situation and baseline data compilation

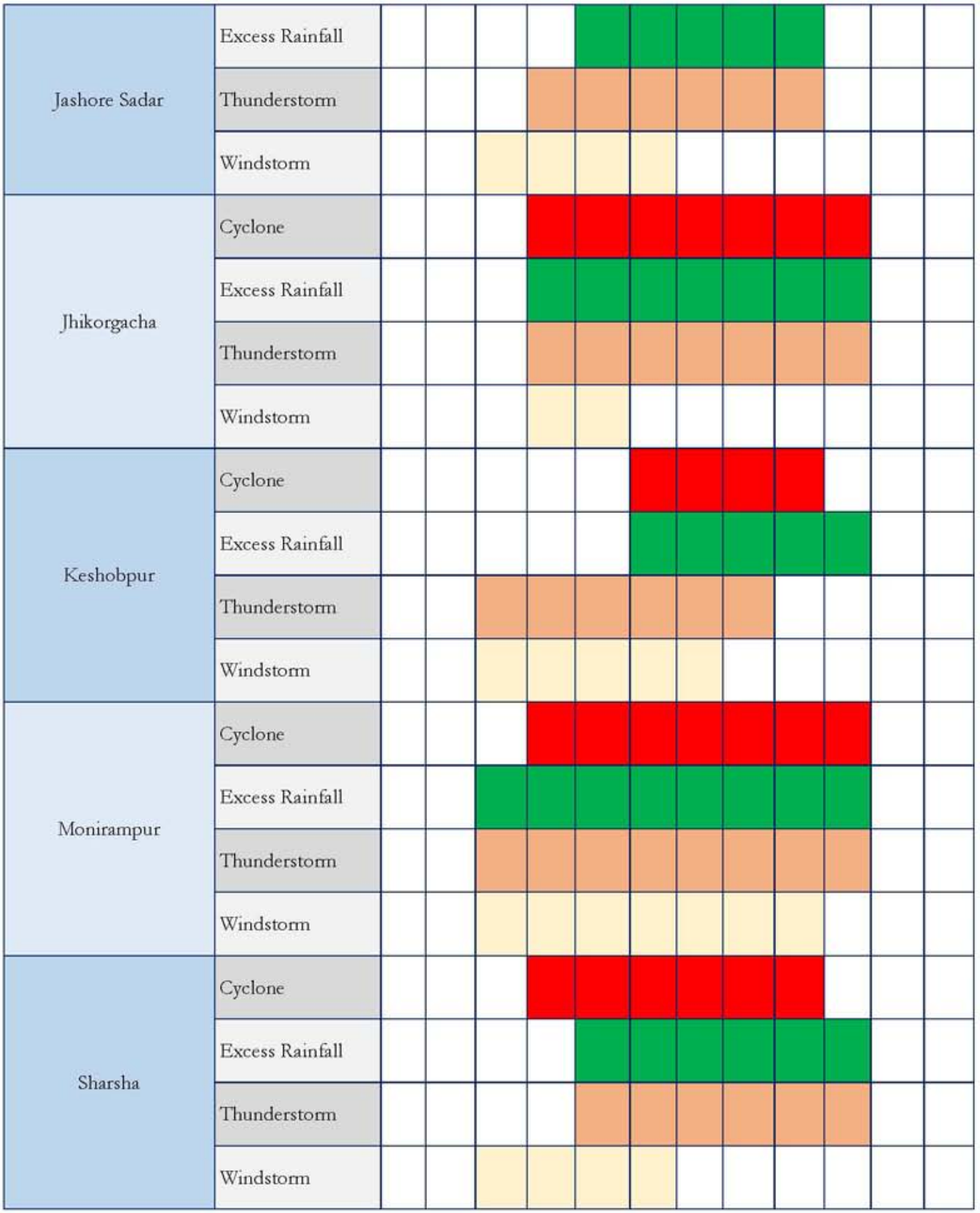
The risk assessment process was an extensive inventory and compilation of existing data and information related to hazards and elements at risk. It involves an understanding of the country's disaster risk management framework, practices and institutional set-up. It entails collection of baseline data of the country such as administrative boundaries, infrastructure, socioeconomic data (e.g. demographics, poverty index, employment, agriculture, etc.), spatial data (e.g. Digital Elevation Model, geology, soil, land cover, land use, road network, etc.) and meteorological data (e.g. rainfall, temperature, etc.). The process also include collection of historical disaster events and the damages and losses they caused. The collected data are compiled and structured in different datasets according to its nature, format and contents. Subsequently, the datasets are integrated in the Geographical Information System (GIS) platform and processed into maps and spatial formats. Some of the baseline data are presented in figures and tables. These maps, figures and tables are presented in chapter 3.

2.2 List of disaster and disaster calendar

Each district has different hazards and occurred in different time. To identify the different hazards in particular district one questionnaire form was produced to collect the data from field and compiled together.

Table 2.1: The table shows the disaster calendar of the Jashore district.

Names of Upazila	Names of Disaster	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Abhaynagar	Cyclone												
	Excess Rainfall												
	Thunderstorm												
	Windstorm												
Bagherpara	Excess Rainfall												
	Thunderstorm												
	Windstorm												
Chowgachha	Cyclone												
	Thunderstorm												
	Windstorm												


Jashore Sadar
Excess Rainfall
Thunderstorm
Windstorm
Jhikorgacha
Cyclone
Excess Rainfall
Thunderstorm
Windstorm
Keshobpur
Cyclone
Excess Rainfall
Thunderstorm
Windstorm
Monirampur
Cyclone
Excess Rainfall
Thunderstorm
Windstorm
Sharsha
Cyclone
Excess Rainfall
Thunderstorm
Windstorm

2.3 Hazard assessment and mapping

Hazard assessment and mapping is the first step of the risk assessment process. It involves characterizing the hazards in terms of its spatial distribution, frequency and intensity. It covers four major hazards that are prevalent in Jashore district namely, cyclone, excess rainfall, thunderstorm and windstorm. Specific hazard intensity maps are produced per hazard. The hazard maps identify the hazard-prone areas, describe the physical characteristics of the hazards and characterize the hazards in terms of magnitude, frequency, duration, extent, intensity and probability. The hazard assessment and mapping phase also entails building of plausible scenarios for each hazard and developing hazard intensity maps.

2.4 Exposure assessment

Identifying and assessing the elements at risk is the next step in the risk assessment process. Exposure assessment is an intermediate stage of risk assessment, which links the hazard assessment with the targeted elements under consideration for the risk assessment (ADPC, 2013). The elements at risks in this study, also labelled as sectors of activity, are population, building, critical facilities such as health and education facilities, infrastructure (e.g. roads) and agriculture. Exposure was quantified and expressed as the number of disaster affect the community (or human lives).

Table 2.2: Elements considered in the assessment for each hazard

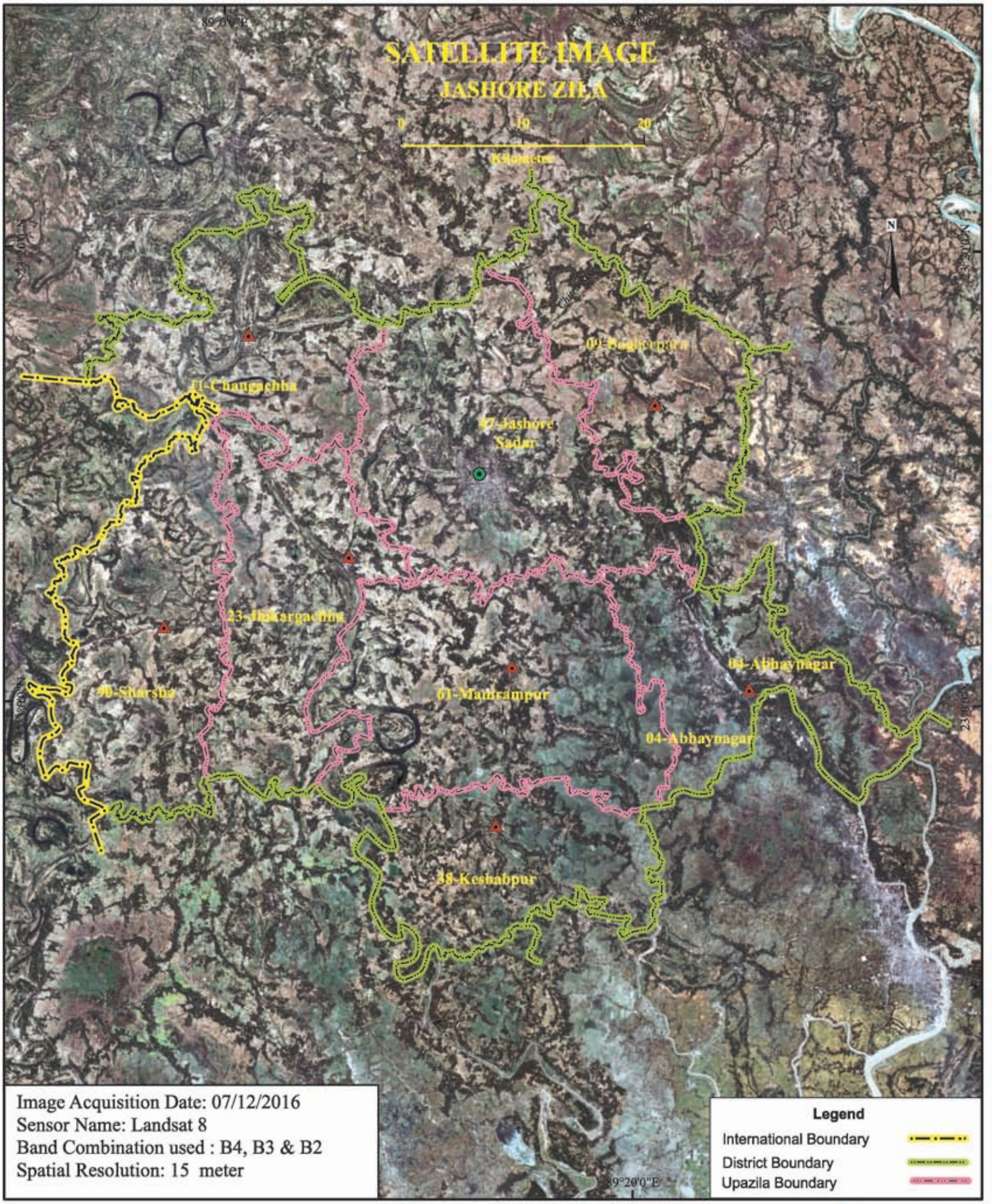
Type	Population	Settlement
Coastal Flood	√	√
Windstorm	√	√
Thunderstorm	√	√
Cyclone	√	√
Excess Rainfall	√	√
Strom surge/Tidal bore	√	√
Water logging	√	√
Tornado	√	√

The exposure assessment is aimed at creating a national database of elements at risks. It qualifies the elements located in hazard-prone areas. The goal is to develop a comprehensive profile of elements at risk and analysis of their exposure to various natural hazards. The analysis is carried out based on available data.

2.5 Satellite imagery and processing

The cloud free multi-spectral Landsat-8 images of 7 December 2016 were downloaded for better visualization. The Landsat-8 image has 11 bands with 16-bit radiometric resolution and the spatial resolution was 15 meter. The most familiar Agriculture (B11, B8, B2) indices was used to detect the land-water boundary and agricultural land as well. The agriculture band combination uses SWIR-1 (B11), near-infrared (B8), and blue (B2). It is mostly used to monitor the health of crops because of how it uses short-wave and near-infrared. Both these bands are particularly good at highlighting dense vegetation that appears as dark green. The details of the images are given below:

Satellite Imagery and Processing



Chapter 3

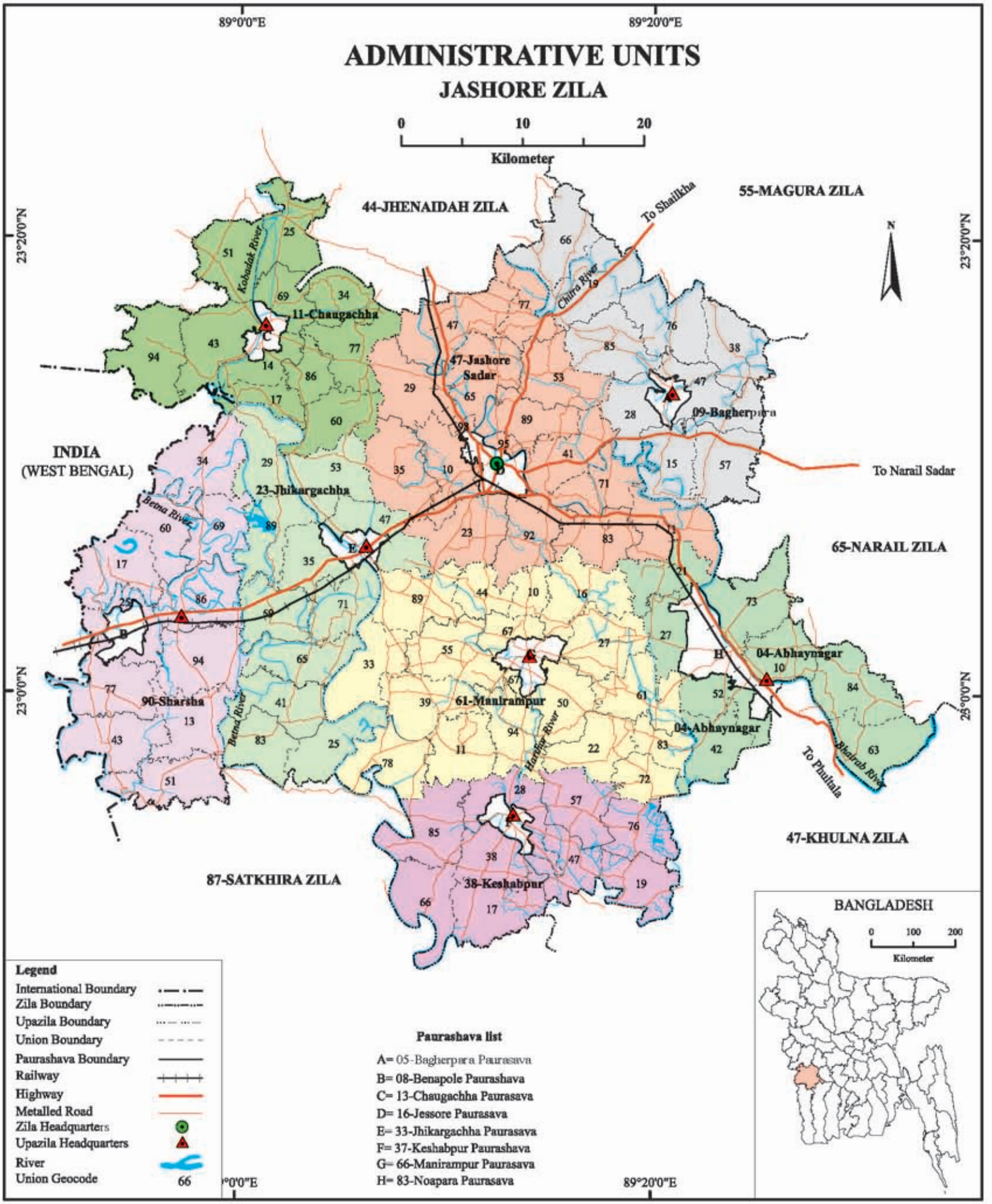
Basic Data and Base Maps of Jashore District

3.1 Geography and administrative division

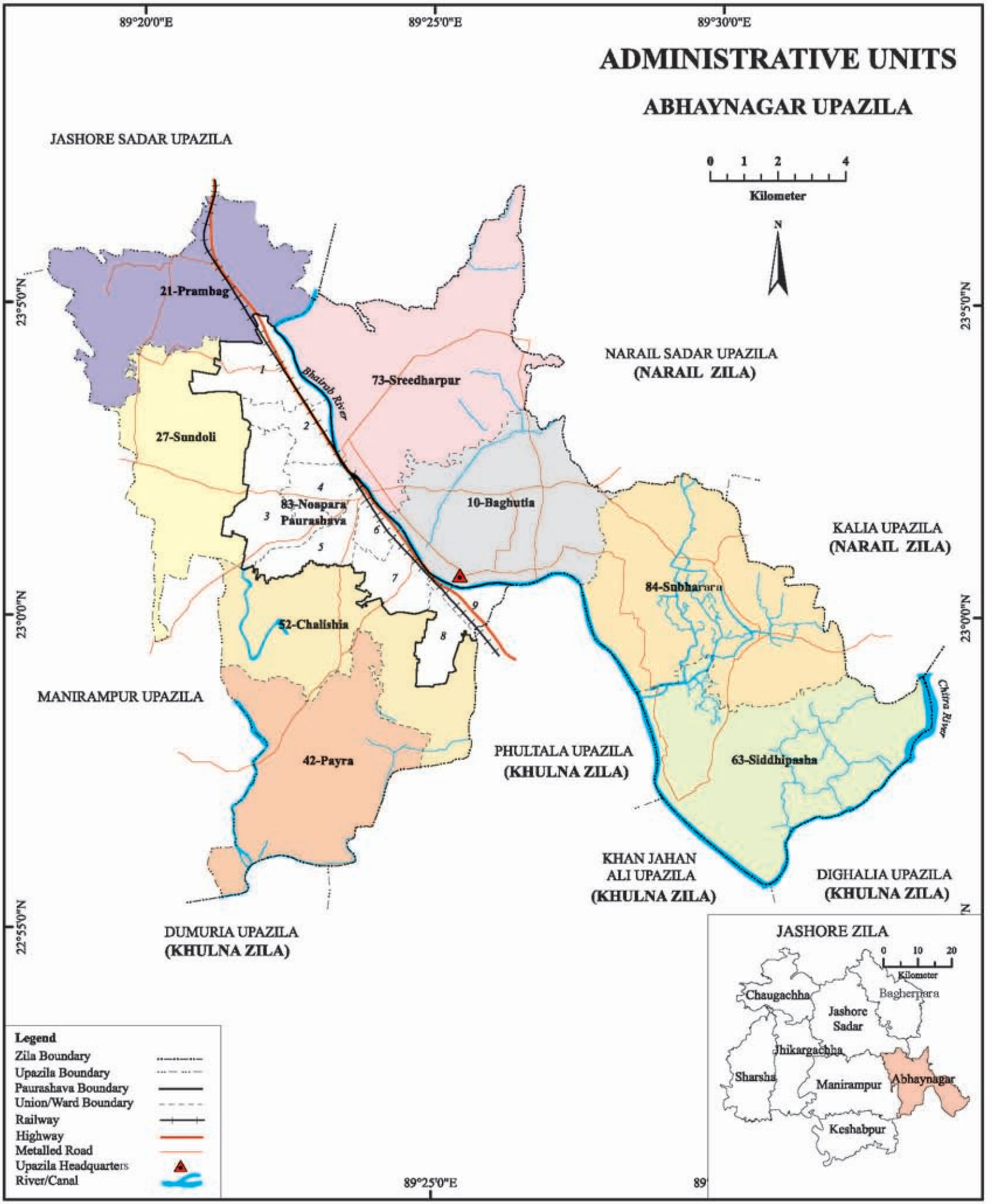
Jashore (previously named as Jessore) district was established in 1781. The area now constituting Jashore district comprises of only former Jashore Sadar subdivision of Jashore district. It was upgraded to district in 1984. It is believed that the name of the district has been originated from the Bangla words Jasho and Har meaning loss of glory. According to Gen. Cunningham the area was previously named as Jasor meaning bridge. The present name Jashore is the phonetic distortion of the word Jasor. The total area of the district is 2606.94 sq. km. (1006.54 sq. miles) of which 23.39 sq. km. (9.03 sq. Km.) is under river area. It lies between 22°48' and 23°22' north latitudes and between 88°51' and 89°34' east longitudes. The district is bounded on the north by Jhenaidah and Magura zilas, east by Narail and Khulna district, south by Khulna and Satkhira district and west by West Bengal state of India.

The district consists of 8 upazilas, 91 unions, 1263 populated mauzas, 1419 villages, 8 paurashavas, 72 wards and 171 mahallas. The upazilas are Abhaynagar, Bagherpara, Chaugachha, Jhikargachha, Keshabpur, Jashore Sadar, Manirampur and Sarsha.

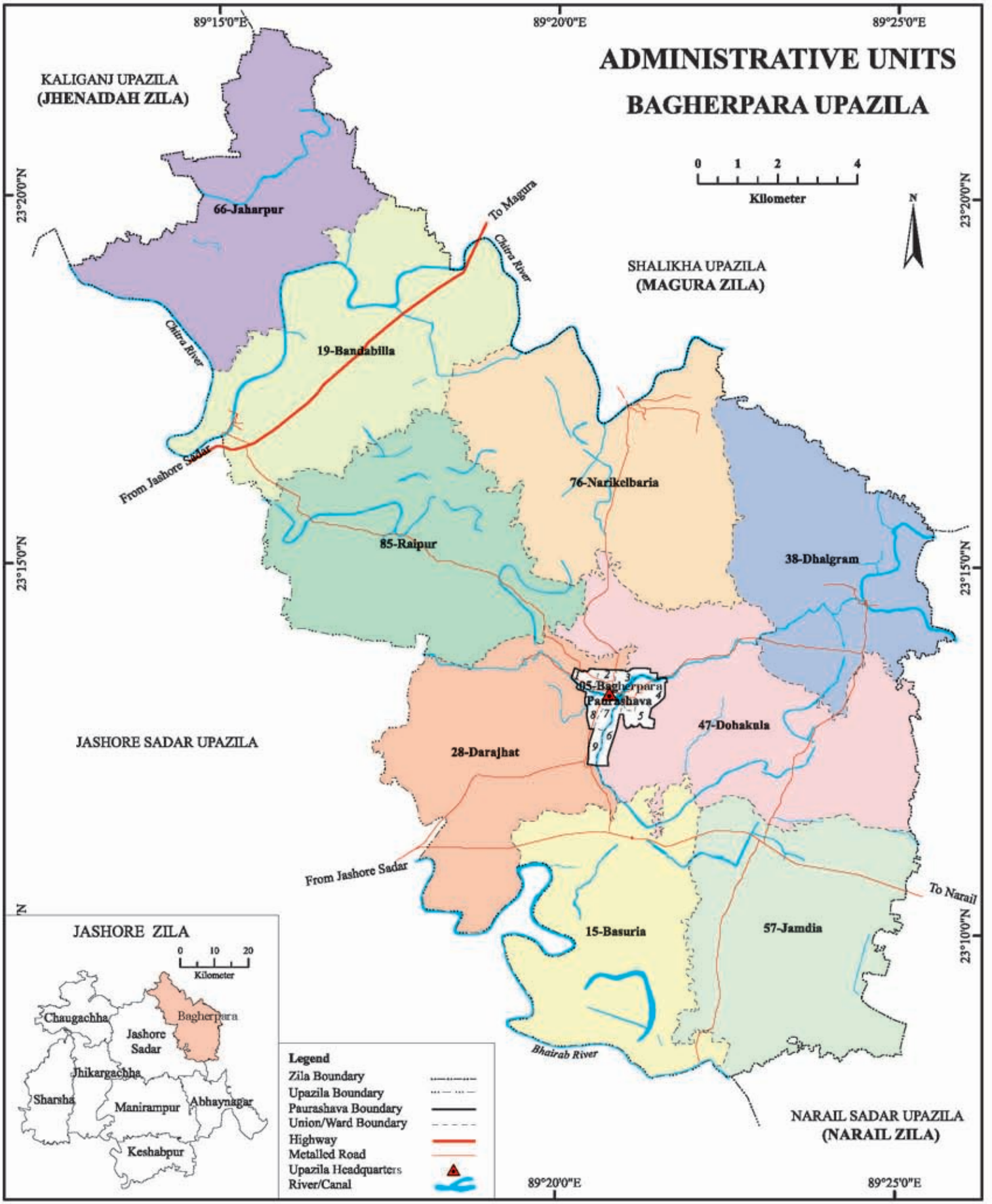
Geography and Administrative Division



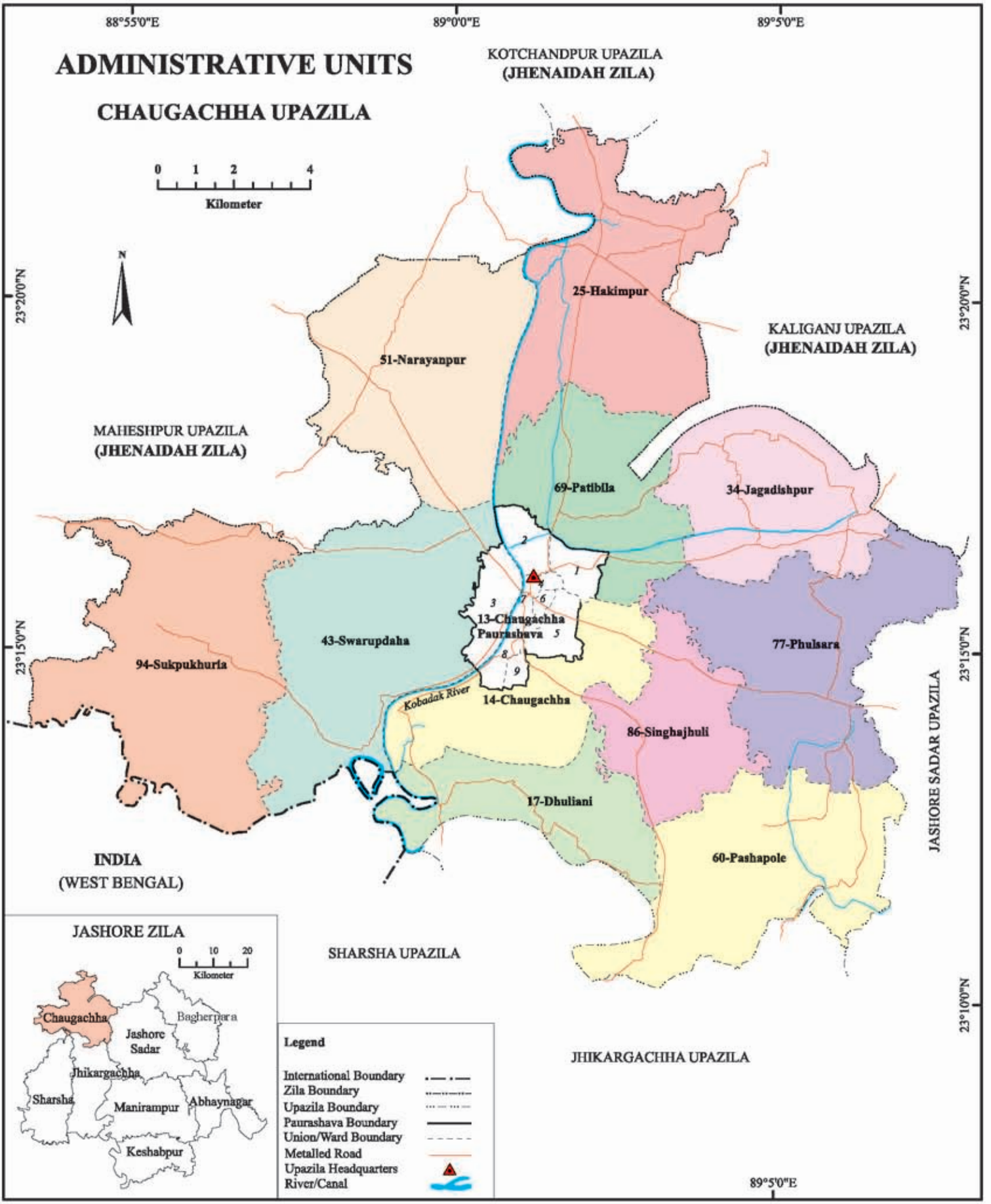
Source: Stat4Dev Project, BBS, 2021



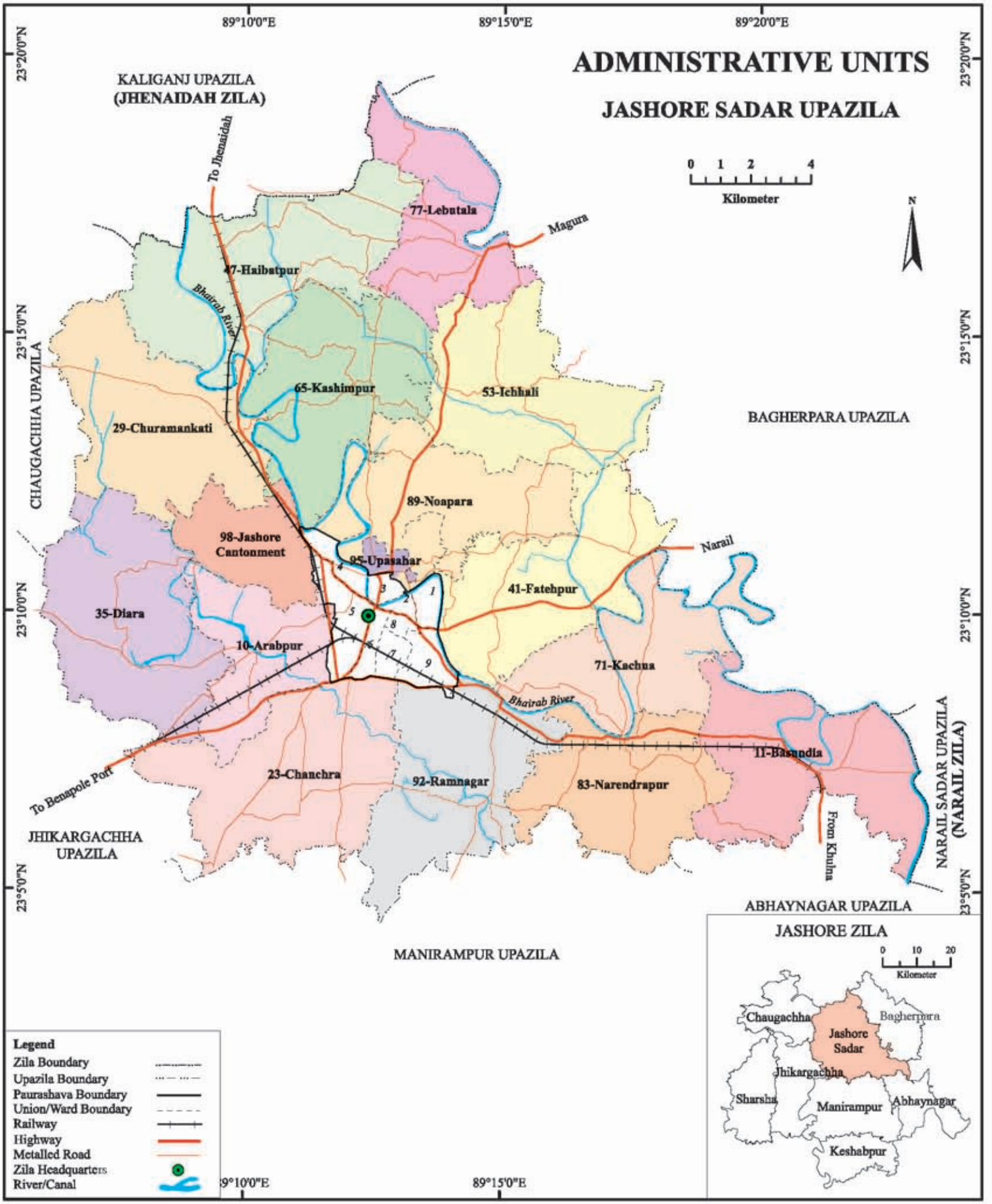
Source: Stat4Dev Project, BBS, 2021



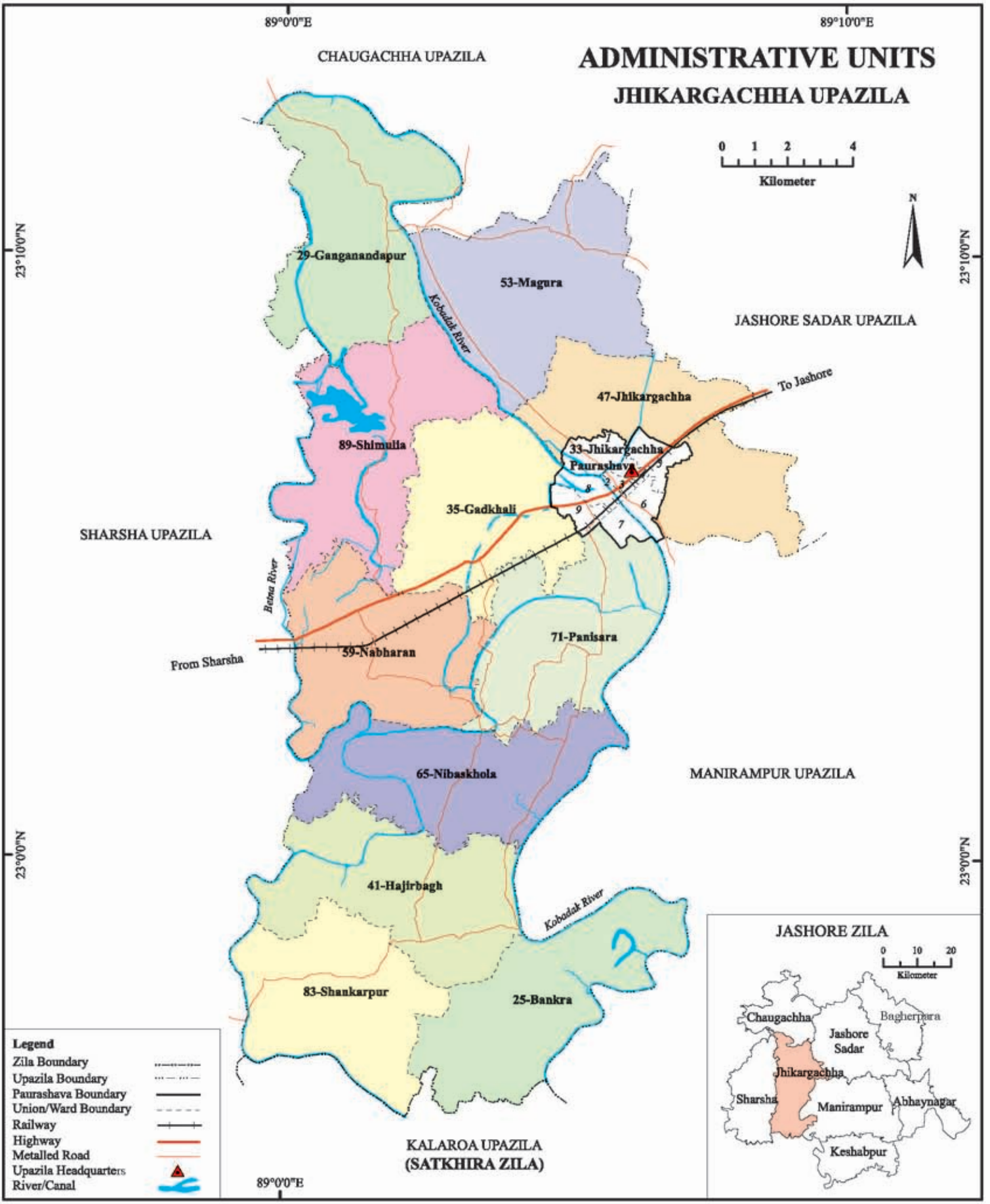
Source: Stat4Dev Project, BBS, 2021



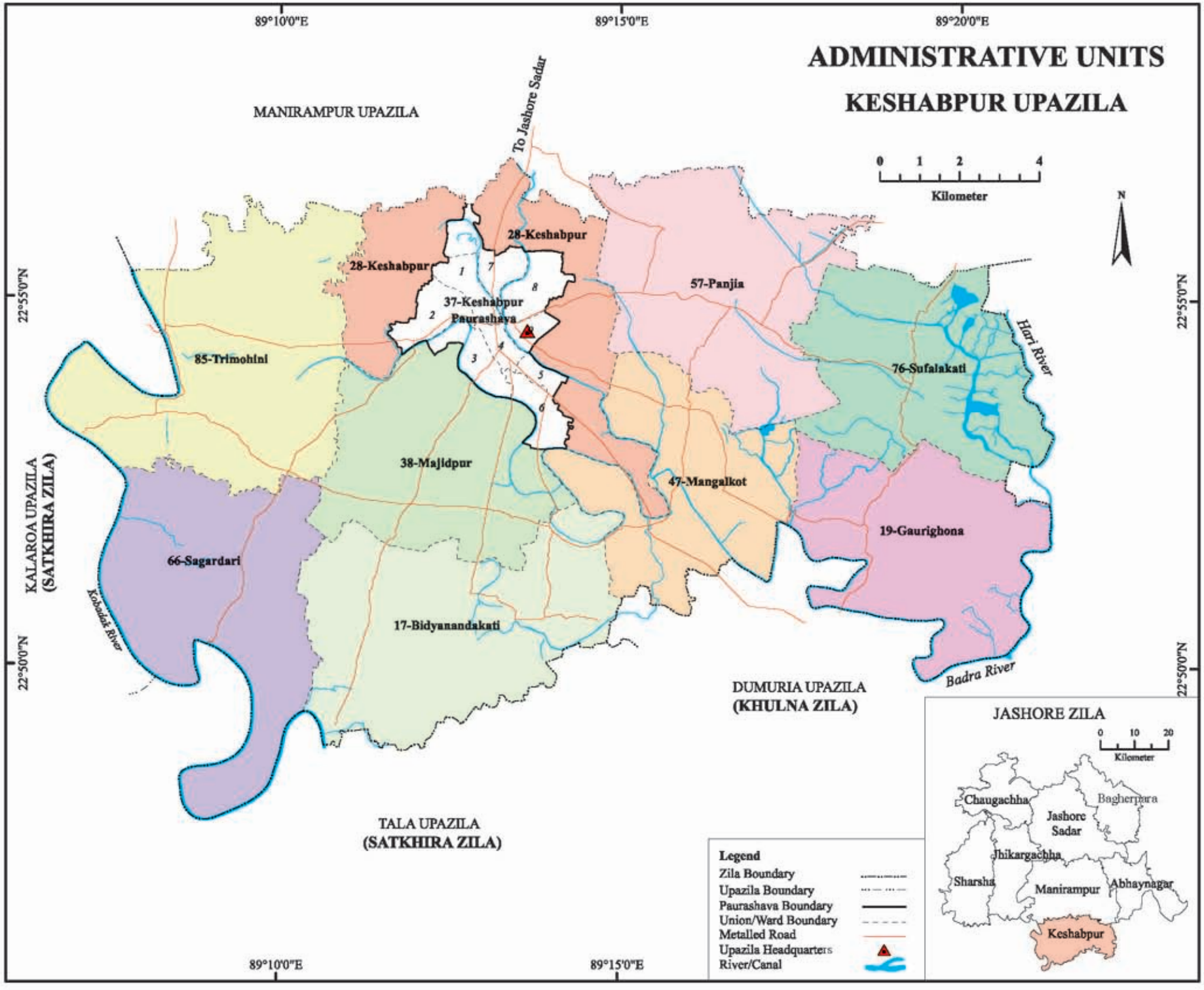
Source: Stat4Dev Project, BBS, 2021



Source: Stat4Dev Project, BBS, 2021

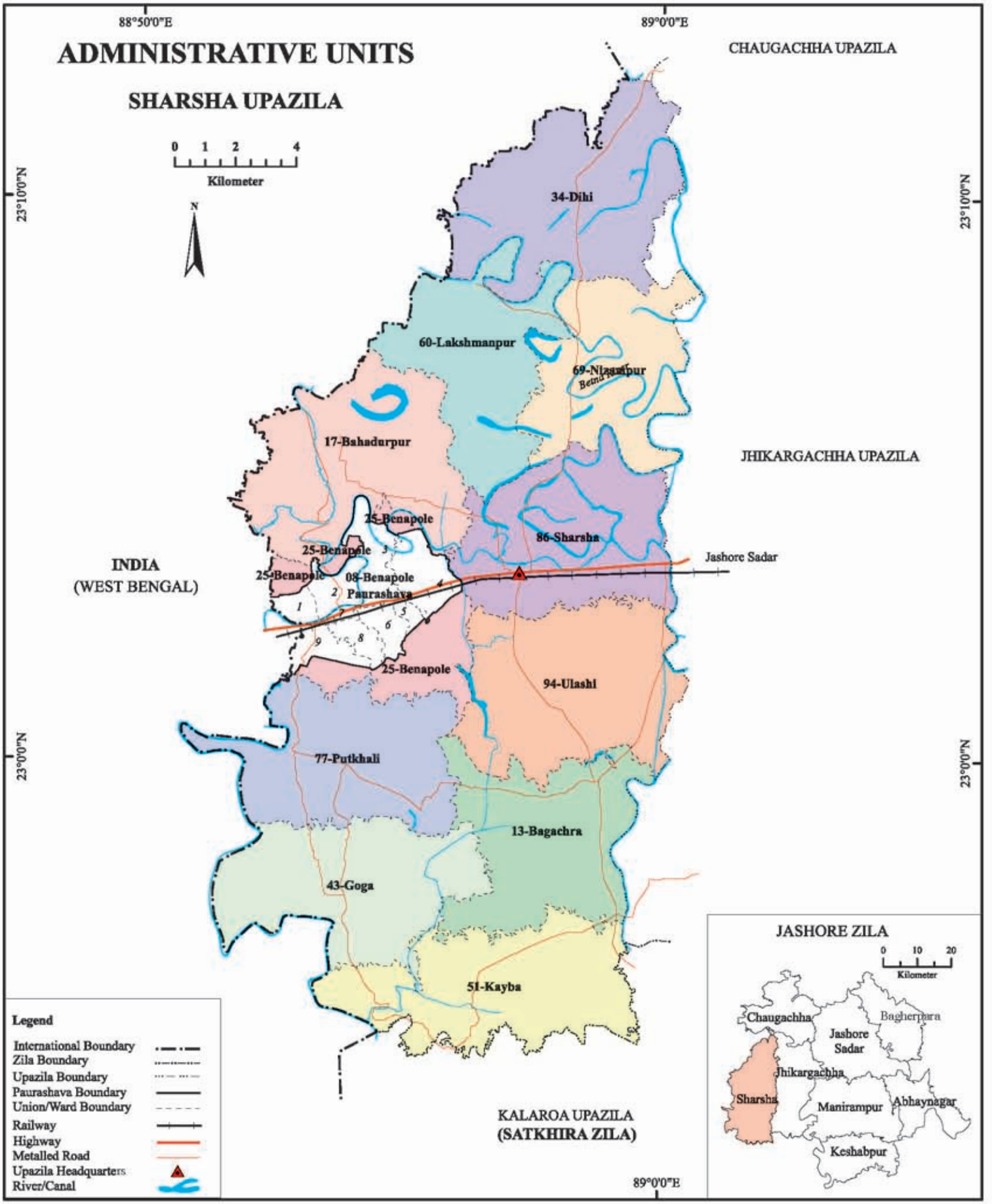


Source: Stat4Dev Project, BBS, 2021



Source: Stat4Dev Project, BBS, 2021


ADMINISTRATIVE UNITS
MANIRAMPUR UPAZILA
89°10'0"E
89°20'0"E
23°0'0"N
JASHORE SADAR UPAZILA
JHIKARGACHHA UPAZILA
ABHAYNAGAR UPAZILA
KALAROA UPAZILA
(SATKHIRA ZILA)
KESHABPUR UPAZILA
DUMURIA UPAZILA
(KHULNA ZILA)
0 1 2 4
Kilometer
N
89-Rohita
4-Kasimpur
10-Bhojgati
9-Dhakuria
67-Manirampur
66-Manirampur Paurashava
27-Haridaskati
55-Khedapara
33-Hariharnagar
39-Jhanpa
61-Kaltia
50-Khanpur
94-Shyamkur
11-Chaluahati
78-Maswimnagar
22-Durbadanga
83-Nehalpur
72-Monoharpur
Harihar River
Mukteshwari River
Kobadak River
JASHORE ZILA
0 10 20
Kilometer
Chaugachha
Bagherpara
Jashore Sadar
Jhikargachha
Sharsha
Manirampur
Abhaynagar
Keshabpur
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union/Ward Boundary
Metalled Road
Upazila Headquarters
River/Canal



Source: Stat4Dev Project, BBS, 2021

3.2 Households

The total household of Jashore district according to Population and Housing Census- 2011 is 656413 of which 120215(18.31%) are in urban area and 536198(81.69%) are in rural area. Households by type are 653423(99.54%) general (dwelling), 469 (0.07%) institutional and 2521 (0.38%) others households in the district.

It is observed that the increase of general household during the decade 2001-2011 are 25.80% in the district as a whole, 46.70% in urban area and 21.97% in rural area. General household by residence is furnished in Table 3.1 for the last five consecutive censuses.

Table 3.1: General household by residence of Jashore district, 1974 – 2011

Residence	2011		2001		1991		1981		1974	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
District	656413	100	519400	100.00	377478	100.00	270142	100.00	217060	100.00
Urban	120215	18.07	80495	15.50	50271	13.32	35127	13.00	14158	6.52
Rural	536198	81.93	438905	84.50	327207	86.68	235015	87.00	20290	93.48

Source: Zila Report, Population and Housing Census 2011, BBS.

It is seen from the above table that the general households have been increasing since 1974 in both urban and rural areas. Percentage of urban households have been increasing more than the rural households. The increasing trend for urban households may be due to migration from rural to urban area. The upward trend of urban general households over the decades registers a record of 148.10% during 1974-1981 indicating a very rapid urbanization in Jashore district immediately after the independence of the country. The urbanization though showed a downward trend 43.11% was over the decade 1981-1991 but again it has gone up to 60.12% in the decade 1991-2001. A downward trend compared to 1991-2001 of 46.70% was observed during 2001-2011 decade. The rural general household recorded the highest 39.23% expansion during 1981-1991 as compared to next decadal increases of 34.14% in 1991-2001 and 21.97% in 2001-2011.

3.3 Population

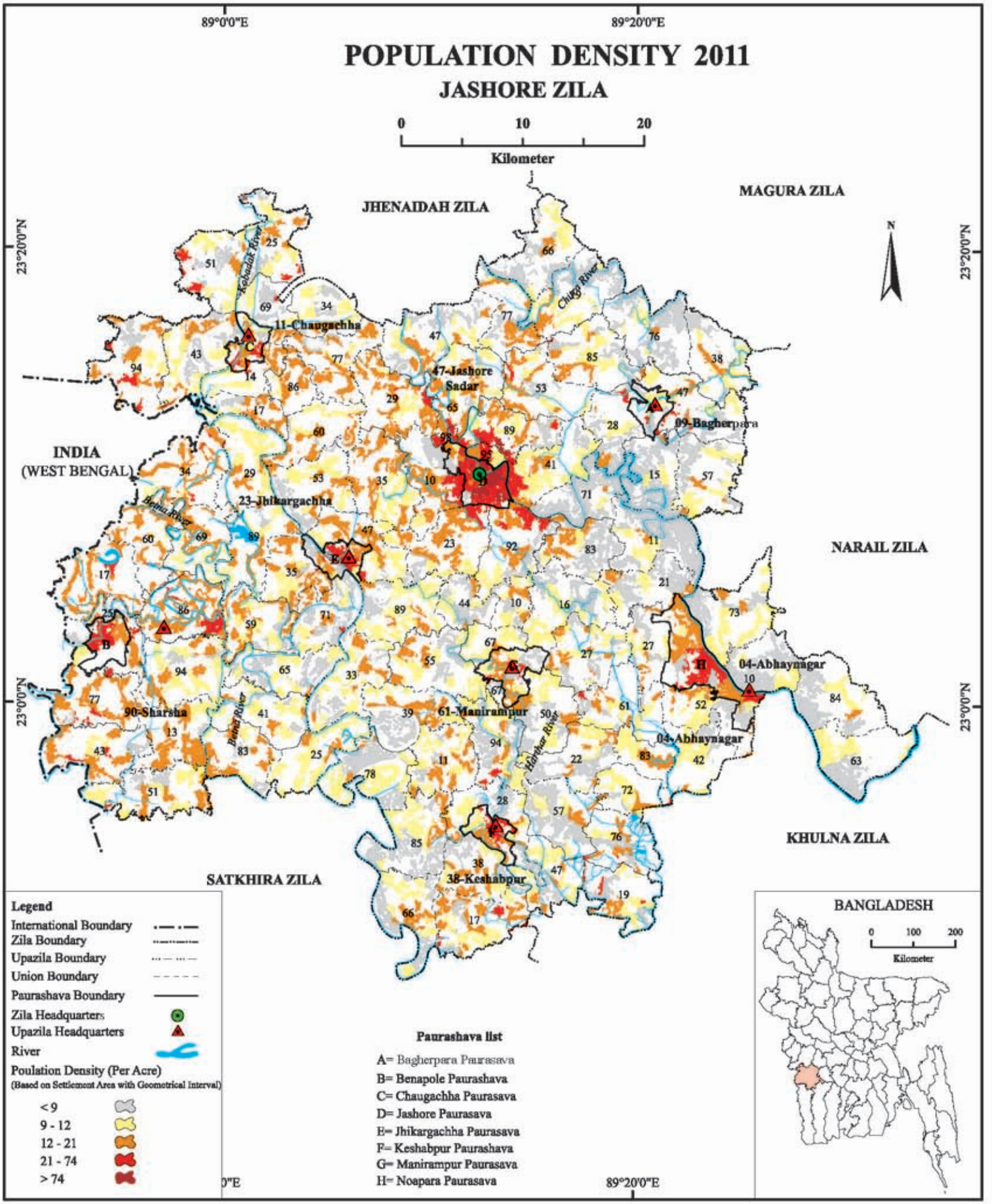
The total population of the district enumerated in 2011 Census is 2764547 of which 513552 (18.58%) are in the urban area and the remaining 2250995 (81.42%) are in the rural area. It is observed that the total population of both urban and rural areas has been increasing but the percent contribution to the total population by rural area has been showing a little decreasing trend since 1981. This particular phenomenon which appeared in Table 3.2 are mainly attributed to the expansion of urban area and possibly due to the migration of a section of people from rural area to urban area.

Table 3.2: General distribution population characteristics of Jashore district, 1981-2011

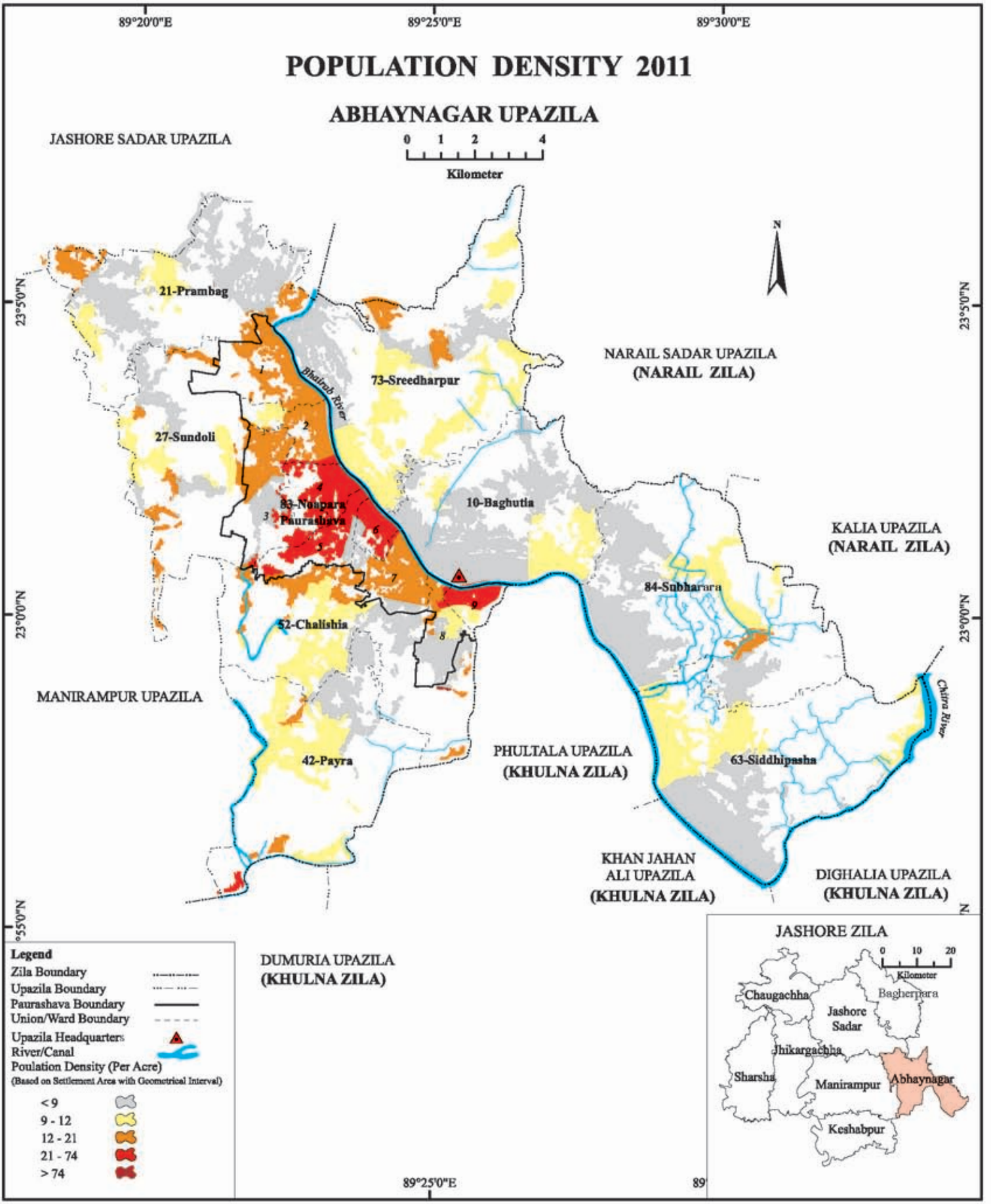
Residence	2011		2001		1991		1981	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Zila	2764547	100.00	2471554	100.00	2106996	100.00	1710608	100.00
Urban	513552	18.58	400851	16.22	282480	13.41	226526	13.24
Rural	2250995	81.42	2070703	83.78	1824516	86.59	1484082	86.76

Source: Zila Report, Population and Housing Census 2011, BBS.

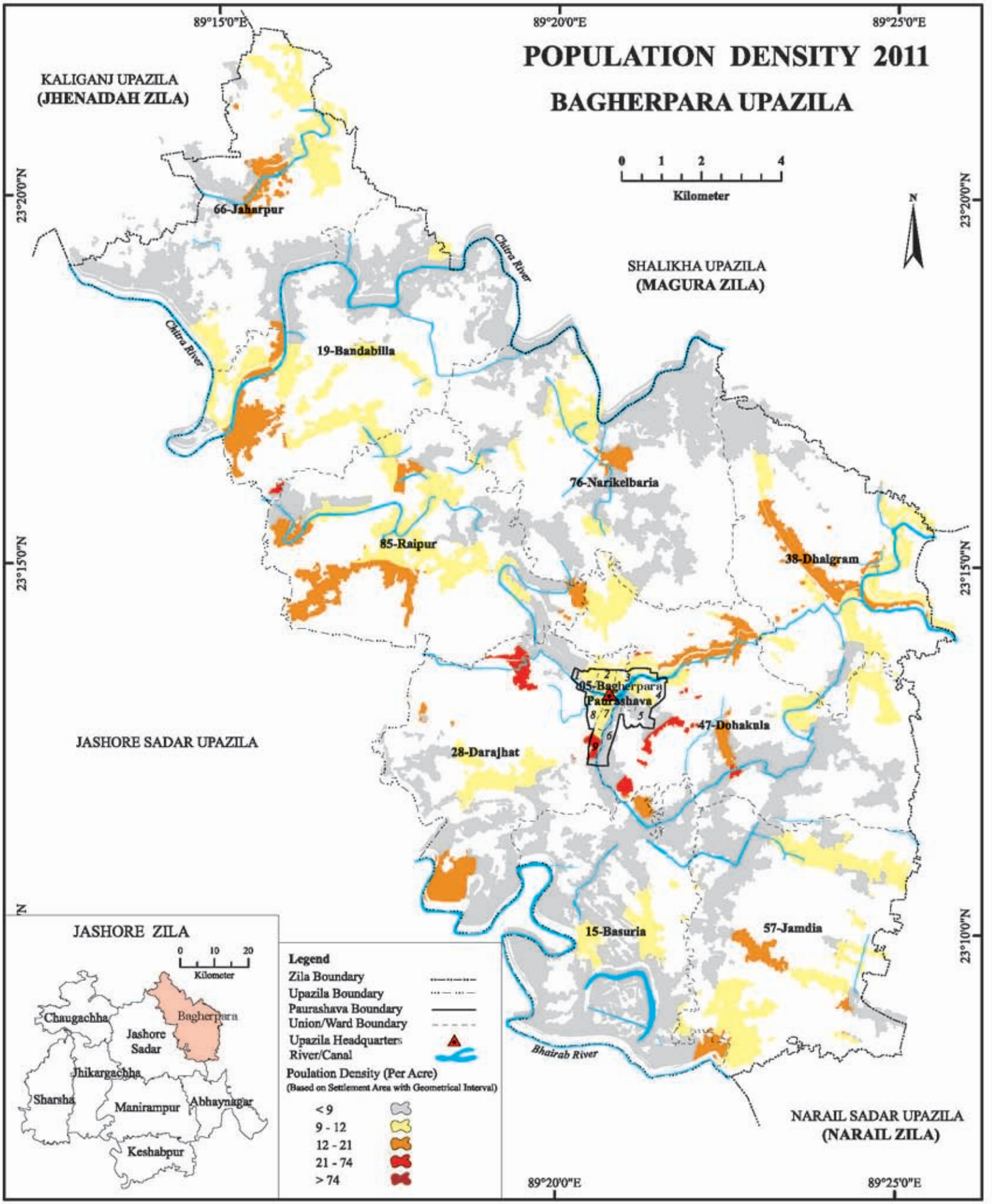
Population and Households



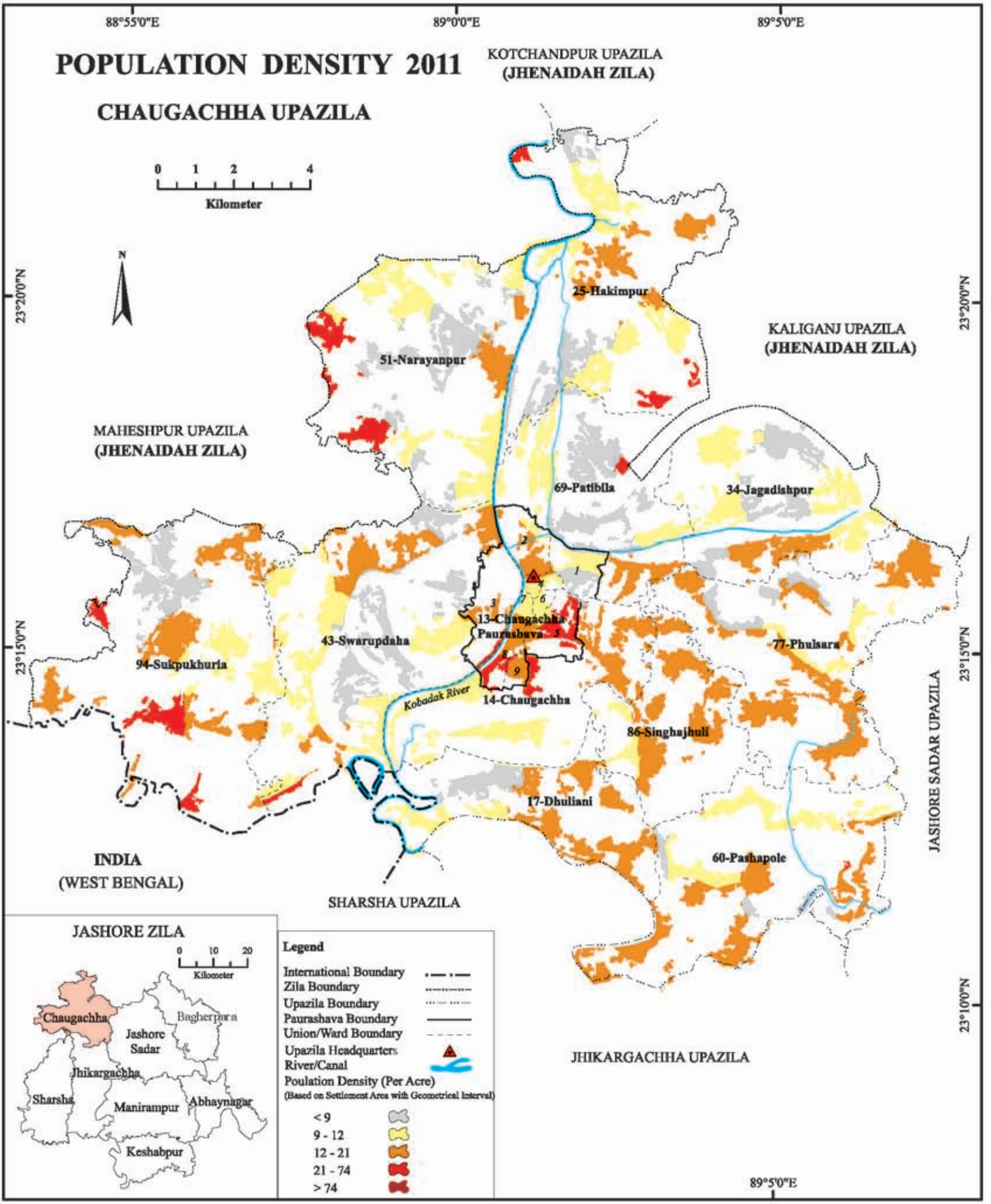
Source: Stat4Dev Project, BBS, 2021



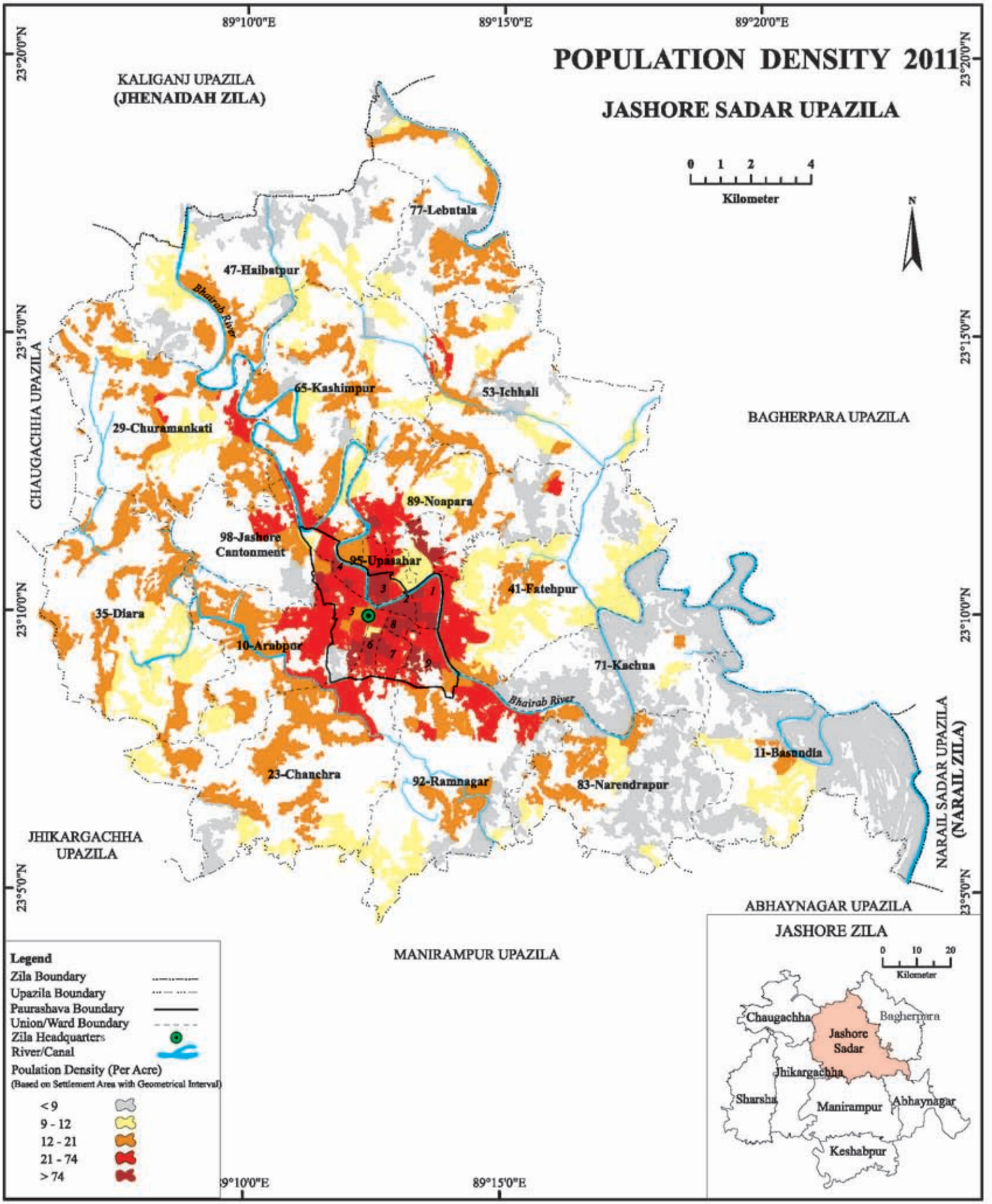
Source: Stat4Dev Project, BBS, 2021



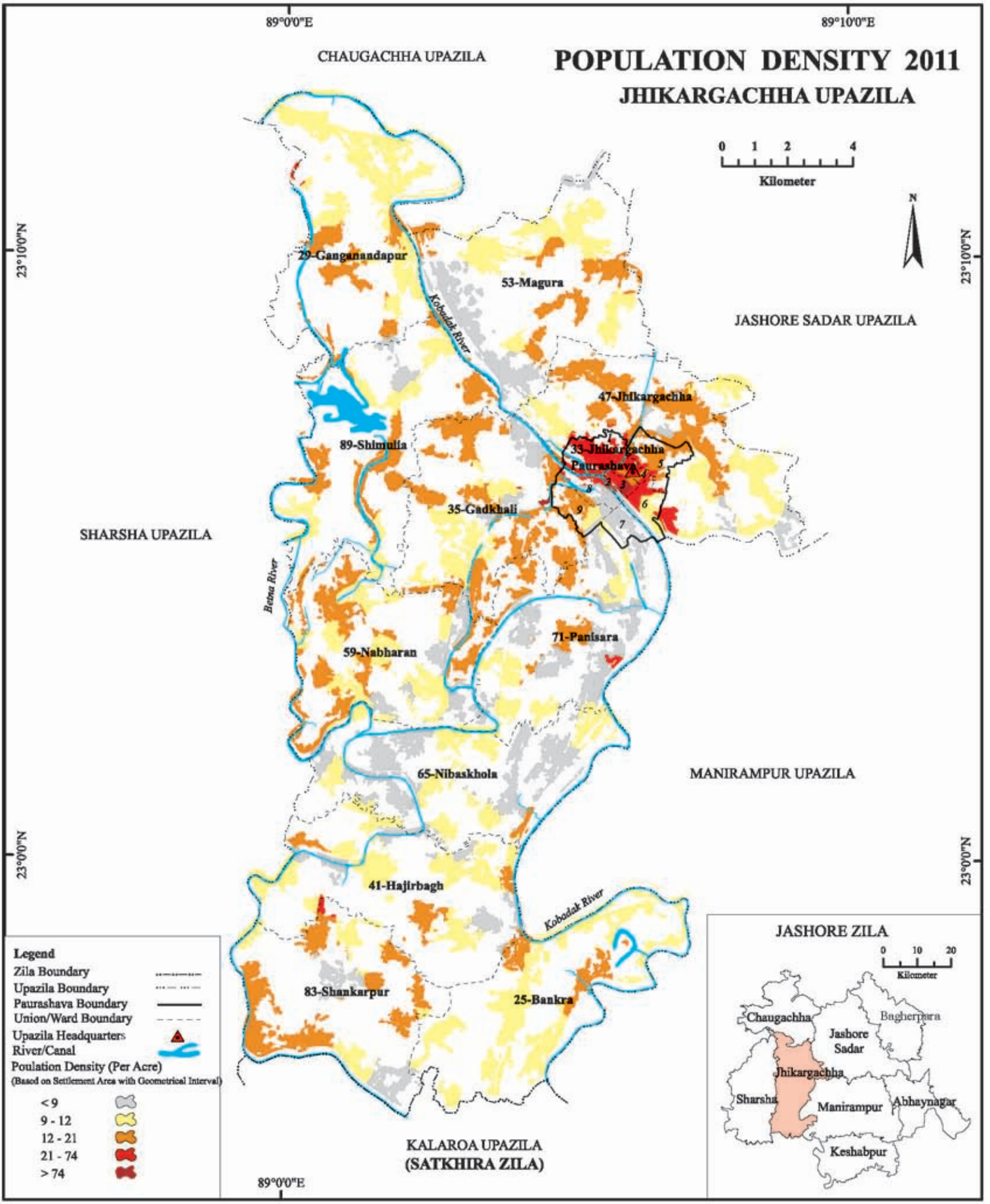
Source: Stat4Dev Project, BBS, 2021



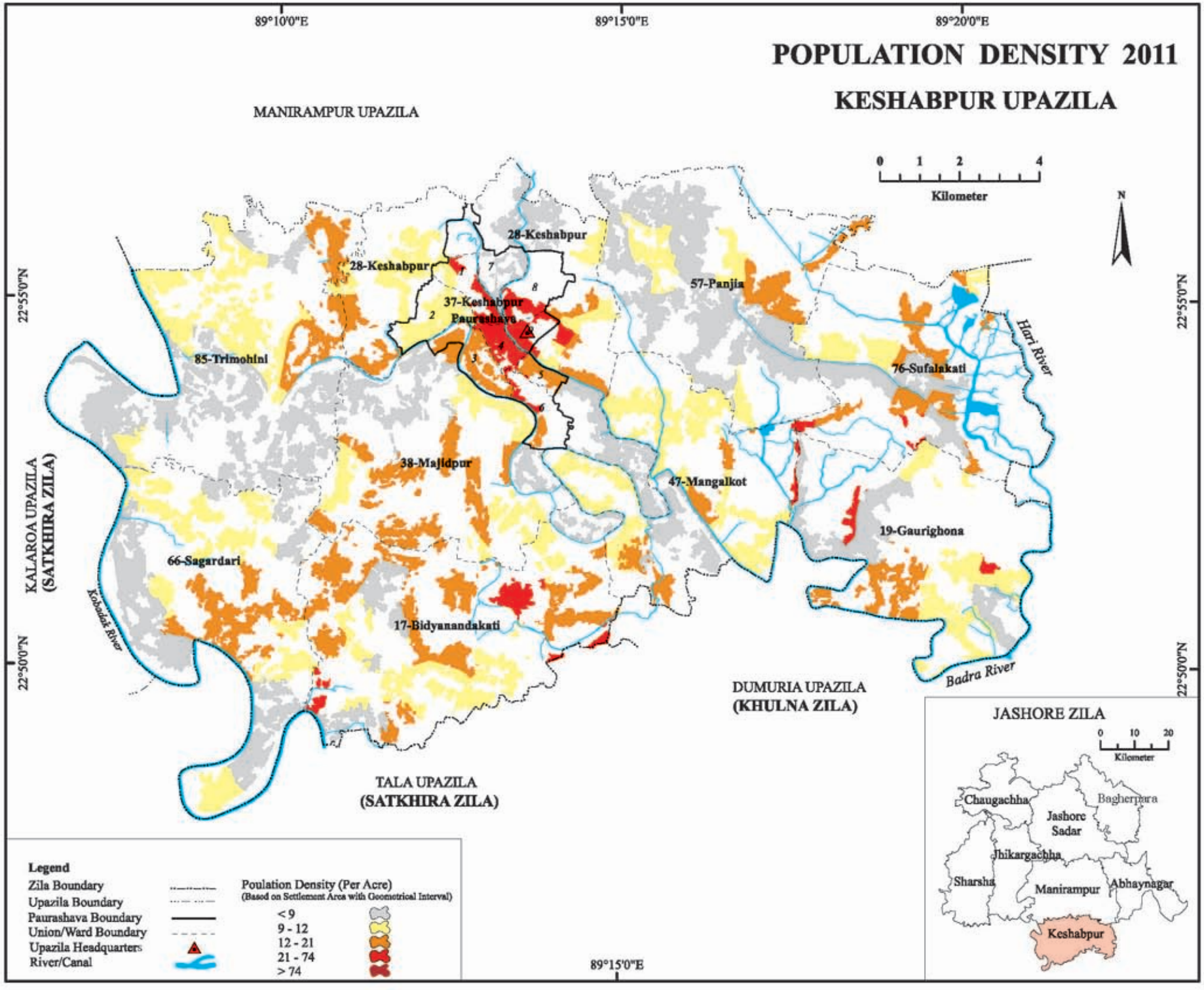
Source: Stat4Dev Project, BBS, 2021

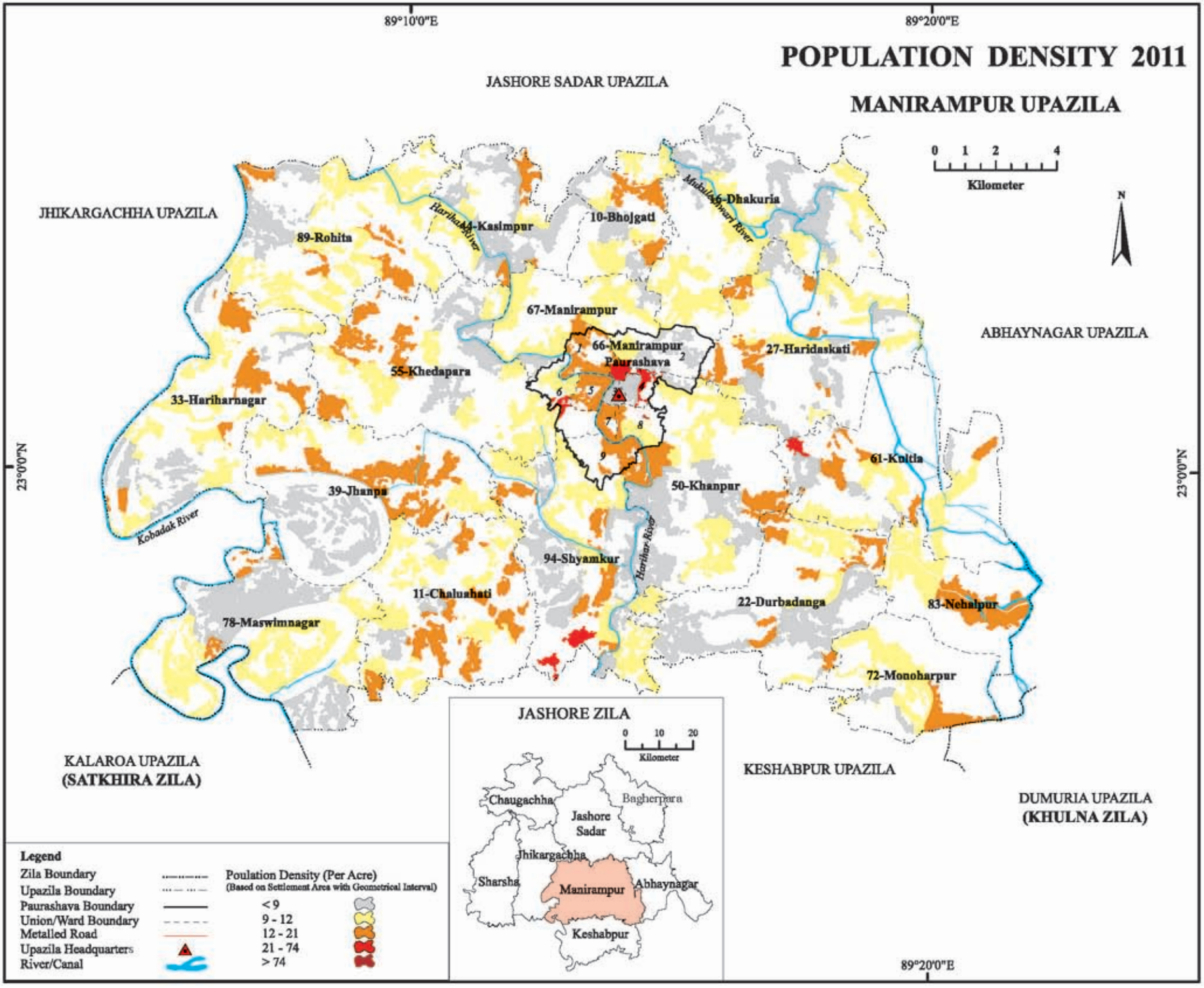


Source: Stat4Dev Project, BBS, 2021

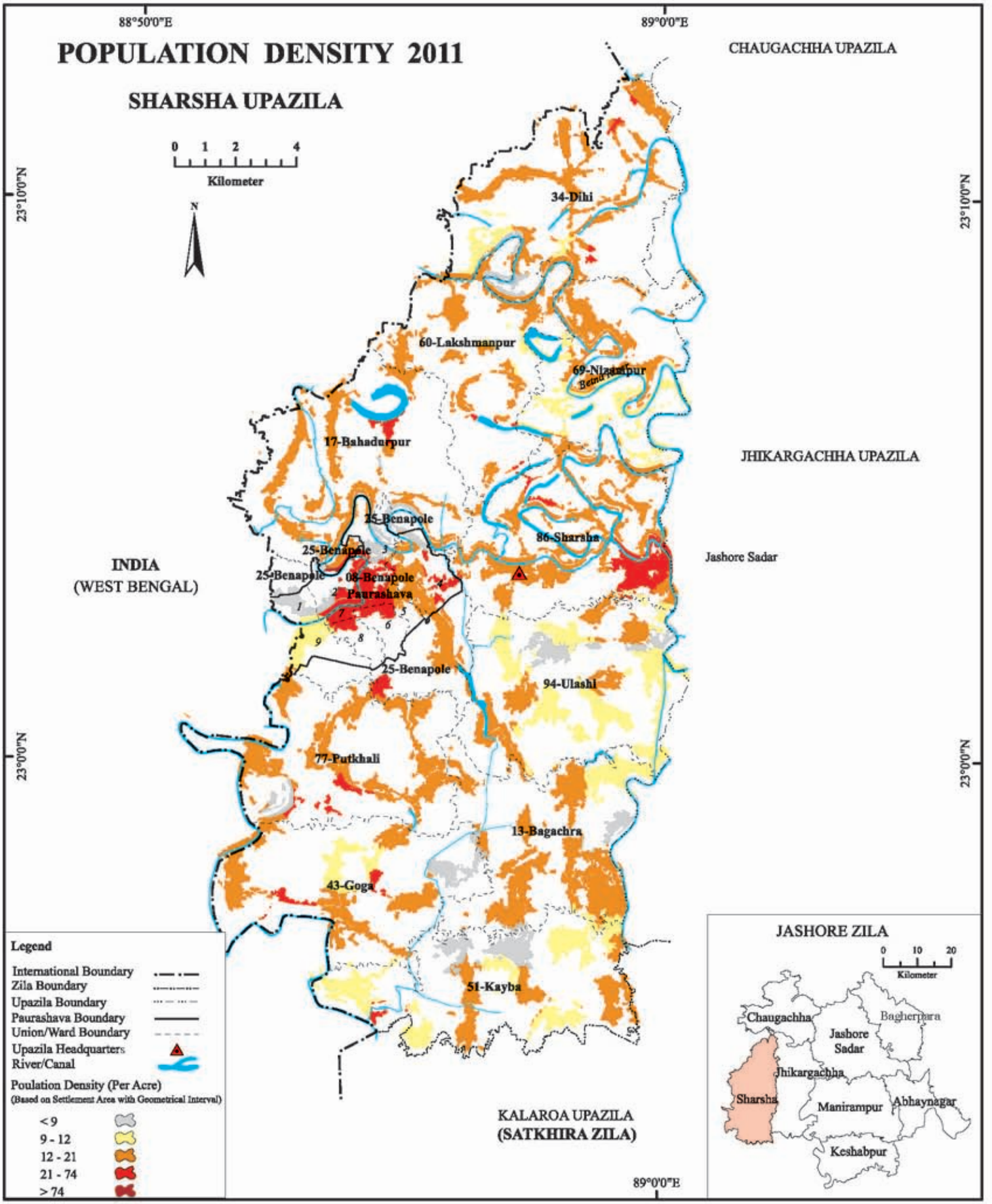


Source: Stat4Dev Project, BBS, 2021


POPULATION DENSITY 2011
KESHABPUR UPAZILA
MANIRAMPUR UPAZILA
89°10'0"E
89°15'0"E
89°20'0"E
22°55'0"N
22°50'0"N
0 1 2 4
Kilometer
N
28-Keshabpur
28-Keshabpur
37-Keshabpur Paurashava
57-Panjia
85-Trimohini
76-Sufalakati
Hari River
38-Majidpur
47-Mangalkot
19-Gaurighona
66-Sagardari
17-Bidyanandakati
Kobadak River
Badra River
KALAROA UPAZILA (SATKHIRA ZILA)
DUMURIA UPAZILA (KHULNA ZILA)
TALA UPAZILA (SATKHIRA ZILA)
JASHORE ZILA
0 10 20
Kilometer
Chaugachha
Bagherpara
Jashore Sadar
Jhikargachha
Sharsha
Manirampur
Abhaynagar
Keshabpur
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union/Ward Boundary
Upazila Headquarters
River/Canal
Poulation Density (Per Acre)
(Based on Settlement Area with Geometrical Interval)
< 9
9 - 12
12 - 21
21 - 74
> 74



Source: Stat4Dev Project, BBS, 2021



Source: Stat4Dev Project, BBS, 2021

3.4 Climate

The climate of Jashore is tropical. The climate is classified as Aw by the Köppen-Geiger system. The average annual temperature in Jashore is 25.5 °C (77.9 °F). With an average of 29.5 °C (85.1 °F), May is the warmest month. In January, the average temperature is 18.4 °C (65.2 °F). It is the lowest average temperature of the whole year. The average temperatures vary during the year by 11.1 °C (19.9 °F). The annual rainfall is 1786 mm (70.3 inch). The driest month is January with 9 mm (0.4 inch) of precipitation. Most precipitation falls in July, with an average of 346 mm (13.6 inch). The precipitation varies 337 mm (13 inch) between the driest month and the wettest month. The month with the highest number of rainy days is July (27.80 days). The month with the lowest number of rainy days is December (1.00 days).The month with the highest relative humidity is September (86.21 %). The month with the lowest relative humidity is March (57.71 %).

Table 3.3: General Climatic characteristics of the Jashore district.

	January	February	March	April	May	June	July	August	September	October	November	December
Temperature °C (°F)	18.4 °C (65.2) °F	22 °C (71.5) °F	26.4 °C (79.4) °F	29.1 °C (84.3) °F	29.5 °C (85.1) °F	28.9 °C (84.1) °F	27.9 °C (82.3) °F	27.8 °C (82.1) °F	27.4 °C (81.3) °F	26.1 °C (78.9) °F	22.9 °C (73.2) °F	19.6 °C (67.3) °F
Min. Temperature °C (°F)	12.3 °C (54.1) °F	15.4 °C (59.6) °F	20.1 °C (68.2) °F	24.4 °C (75.9) °F	25.9 °C (78.6) °F	26.3 °C (79.4) °F	25.8 °C (78.4) °F	25.6 °C (78) °F	25 °C (77) °F	22.6 °C (72.6) °F	17.7 °C (63.9) °F	14 °C (57.1) °F
Max. Temperature °C (°F)	24.8 °C (76.6) °F	28.4 °C (83.1) °F	32.6 °C (90.7) °F	34.7 °C (94.5) °F	34 °C (93.2) °F	32.4 °C (90.4) °F	31 °C (87.9) °F	31 °C (87.9) °F	30.8 °C (87.5) °F	30.2 °C (86.3) °F	28.3 °C (82.9) °F	25.5 °C (77.9) °F
Precipitation / Rainfall mm (in)	9 (0.4)	22 (0.9)	47 (1.9)	115 (4.5)	231 (9.1)	309 (12.2)	346 (13.6)	289 (11.4)	244 (9.6)	133 (5.2)	30 (1.2)	11 (0.4)
Humidity(%)	65%	60%	58%	68%	76%	82%	85%	85%	86%	82%	70%	67%
Rainy days (d)	1	2	4	9	12	17	21	21	18	10	2	1
avg. Sun hours (hours)	9.0	9.4	9.6	8.9	8.1	7.8	7.5	7.6	7.7	8.3	8.8	8.5

Source: climate-data.org

3.5 Land cover

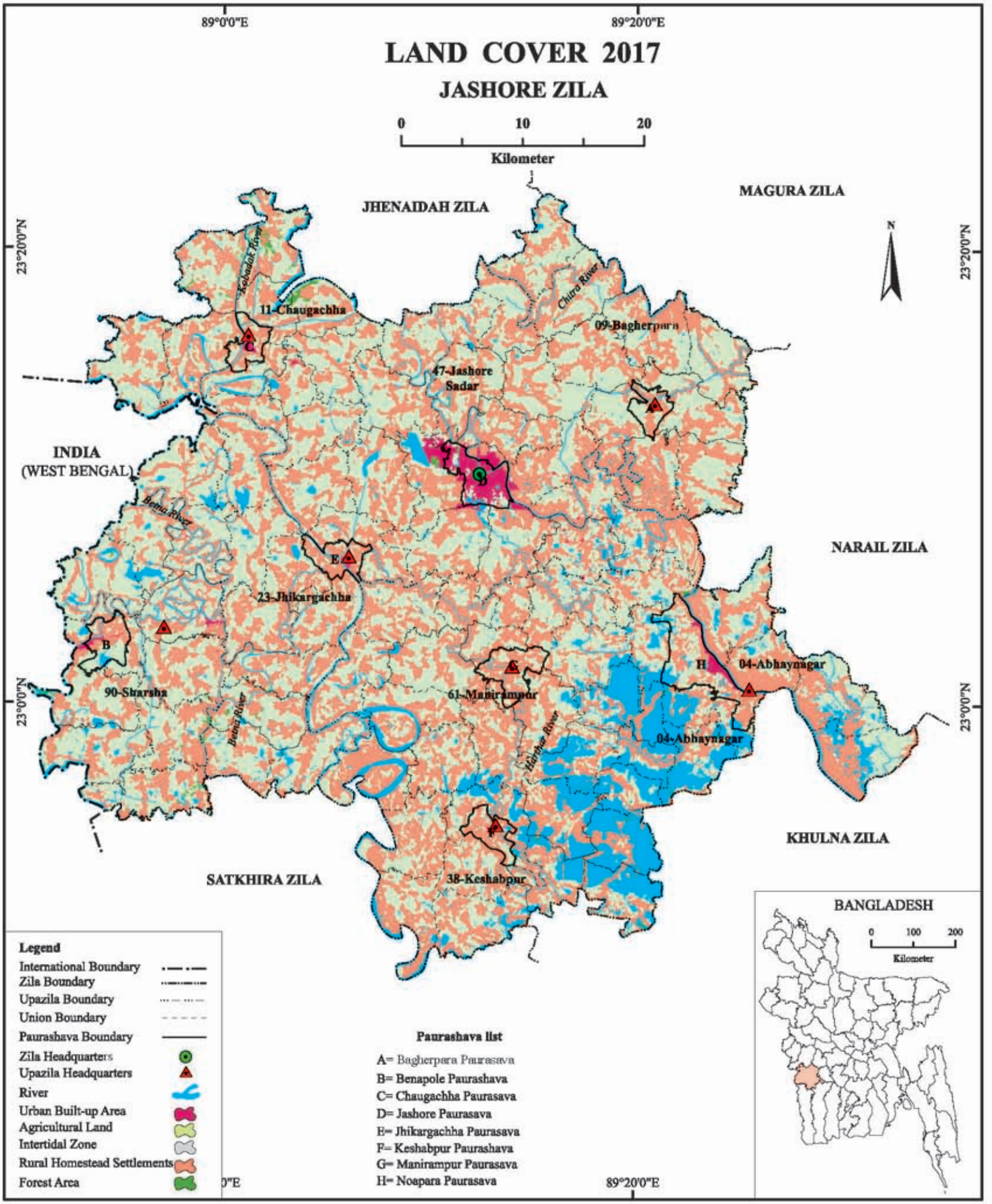
In Jashore, the total land area covers more than 99% of total district area, where the Manirampur is the largest upazila among the upazilas (17% of total land area).

Table 3.4: Land area distribution to different upazilas of Jashore district (in sq km)

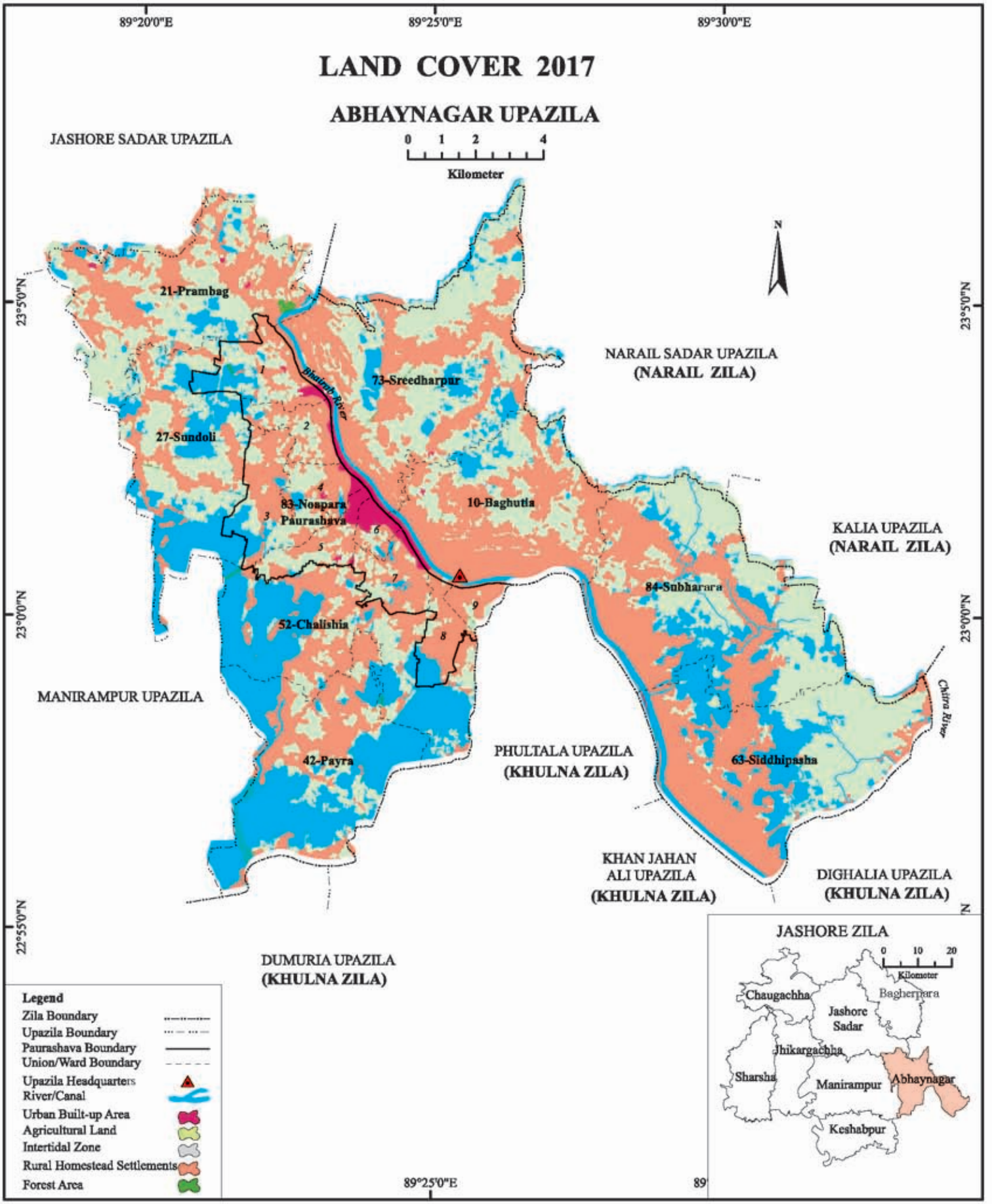
Upazila	Total area	Land area	Reserve forest	Riverine area
Abhaynagar	247.21	245.03	0	2.18
Bagherpara	308.29	305.98	0	2.31
Chaugachha	269.31	267.63	0	1.68
Jessore Sadar	435.22	427.63	0	7.59
Jhikargachha	307.96	305.45	0	2.51
Keshabpur	258.44	254.66	0	3.78
Manirampur	444.2	442.91	0	1.29
Sharsha	336.28	334.23	0	2.05
Total	**2606.94**	**2583.55**	**0**	**23.39**

Source: District Statistics, 2011, BBS.

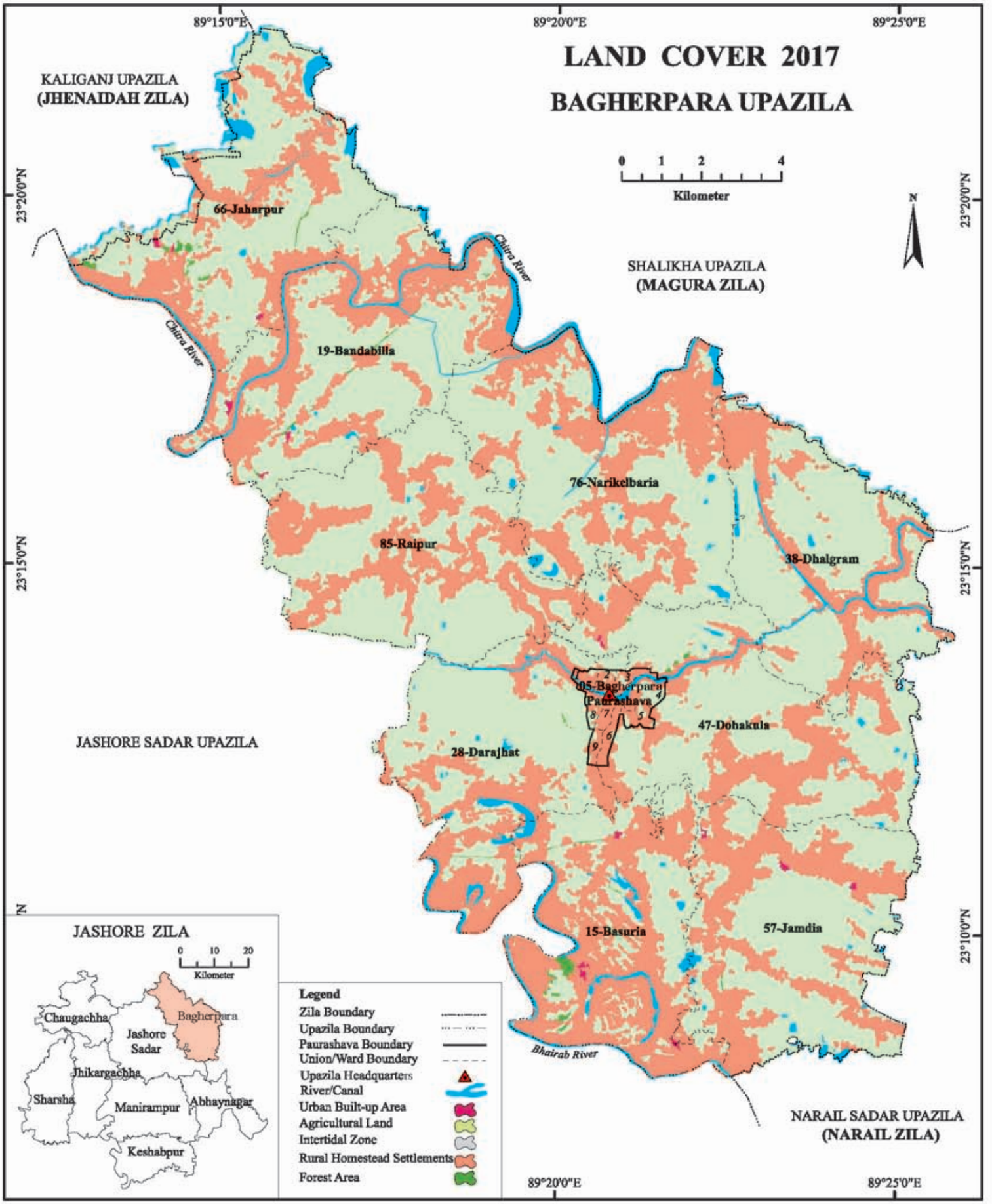
Land Cover
Area Map



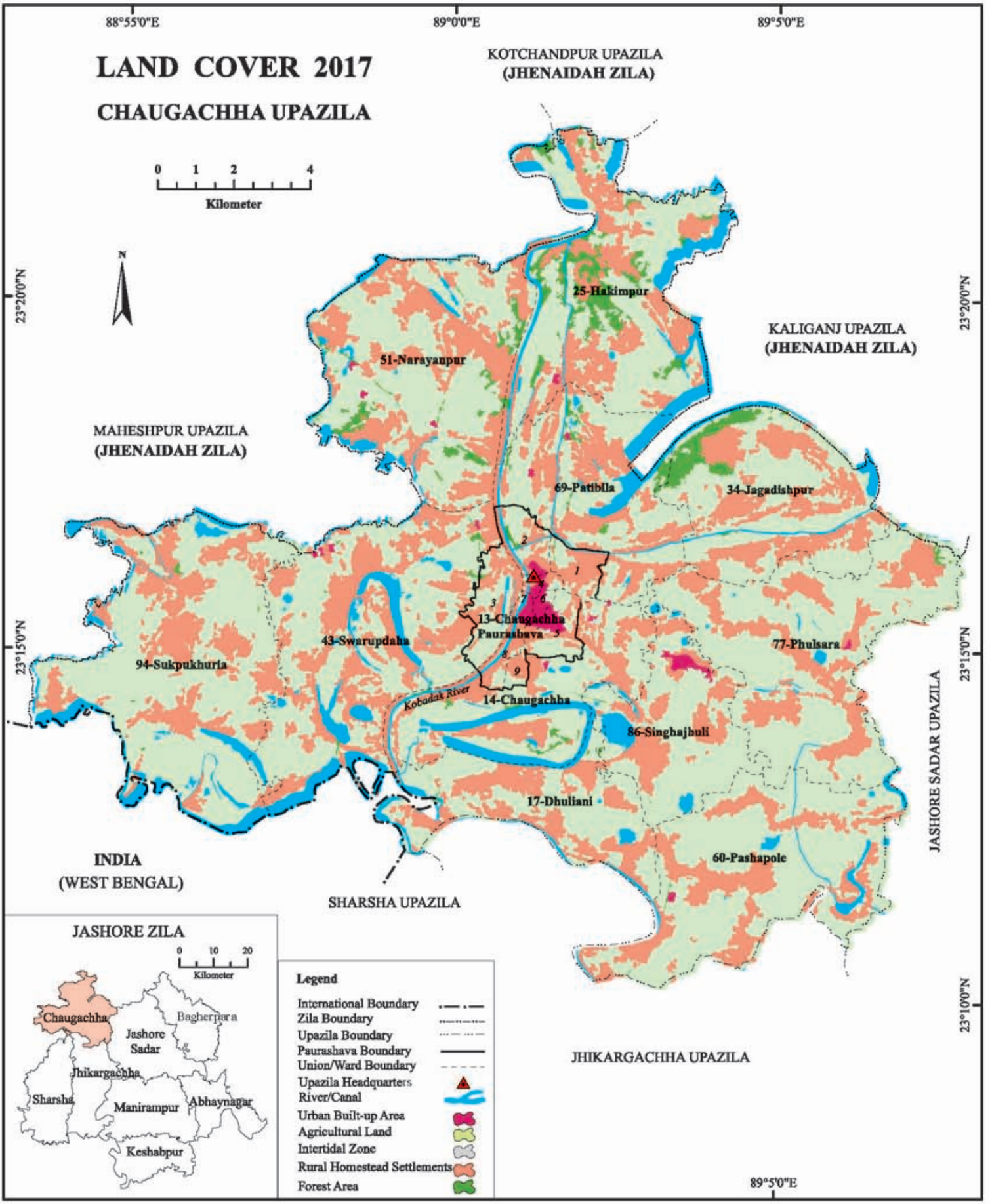
Source: Stat4Dev Project, BBS, 2021



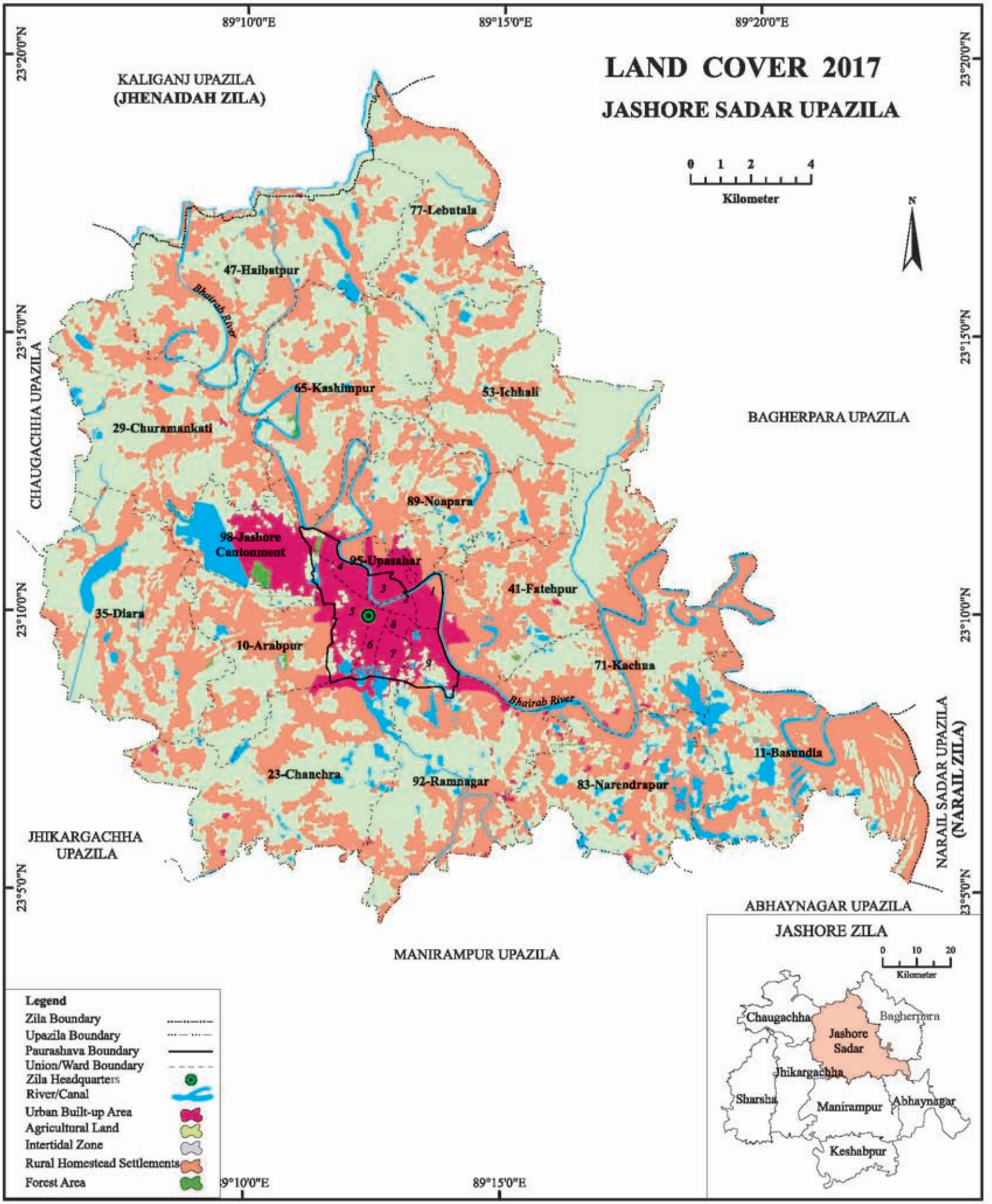
Source: Stat4Dev Project, BBS, 2021



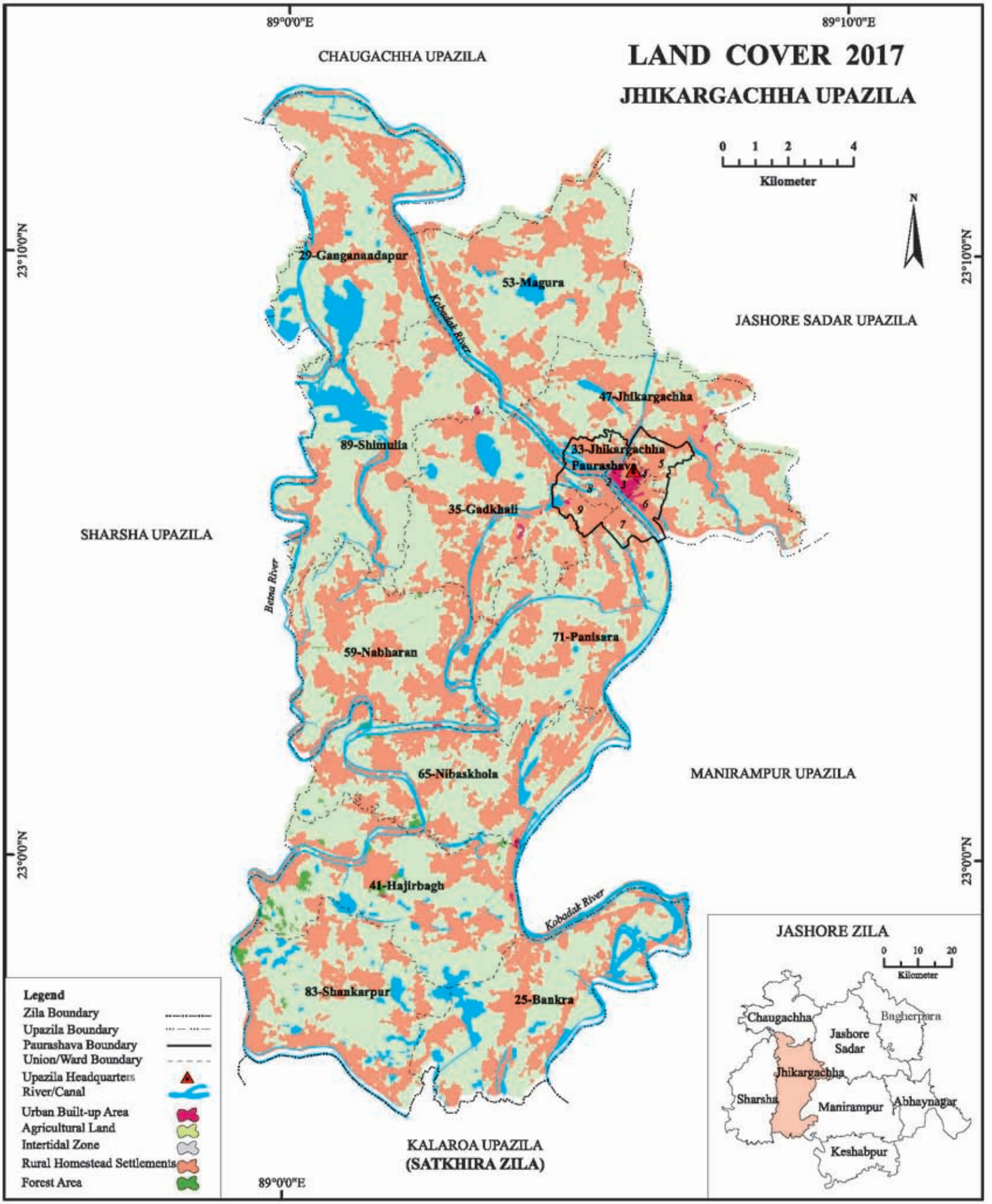
Source: Stat4Dev Project, BBS, 2021



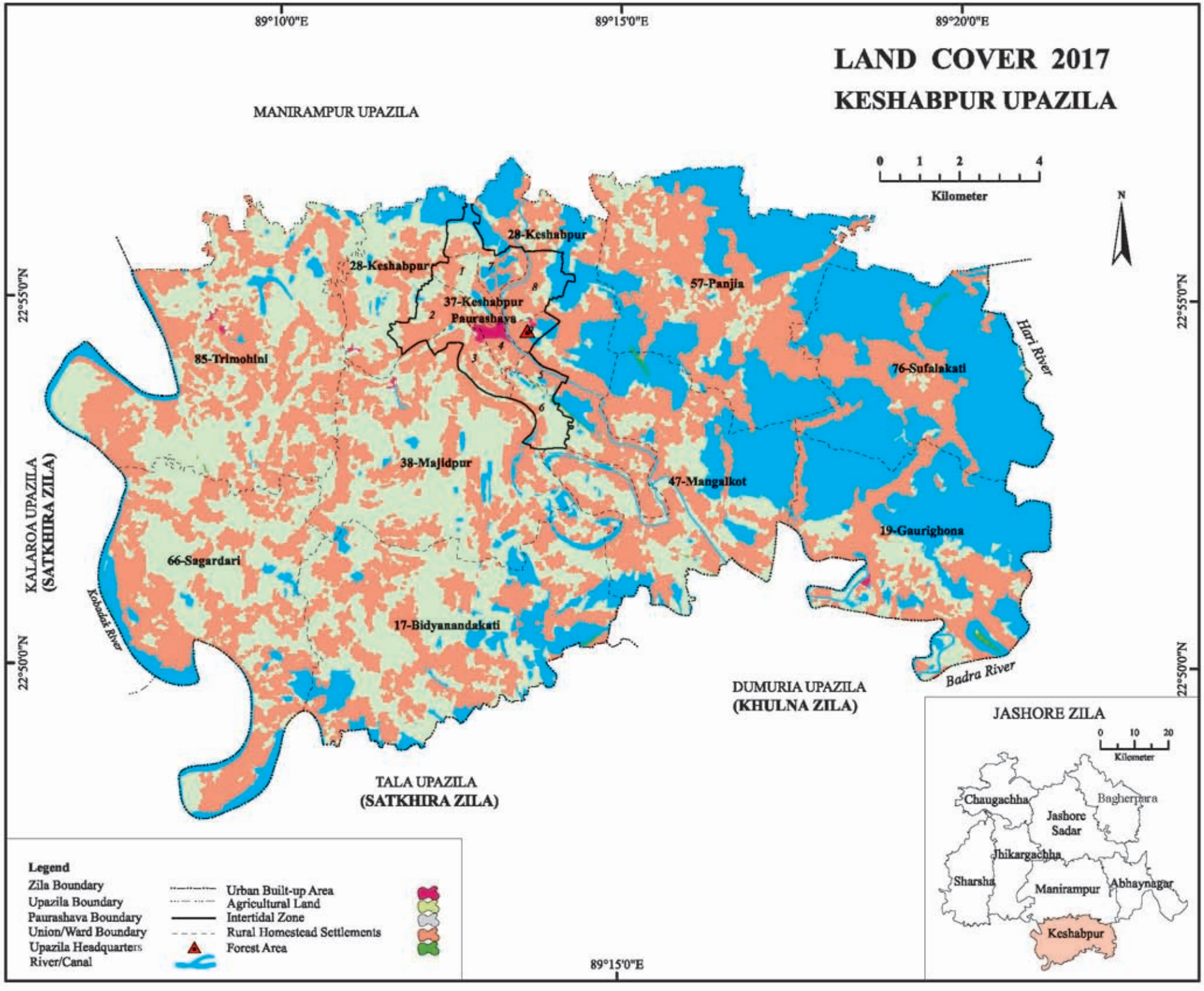
Source: Stat4Dev Project, BBS, 2021



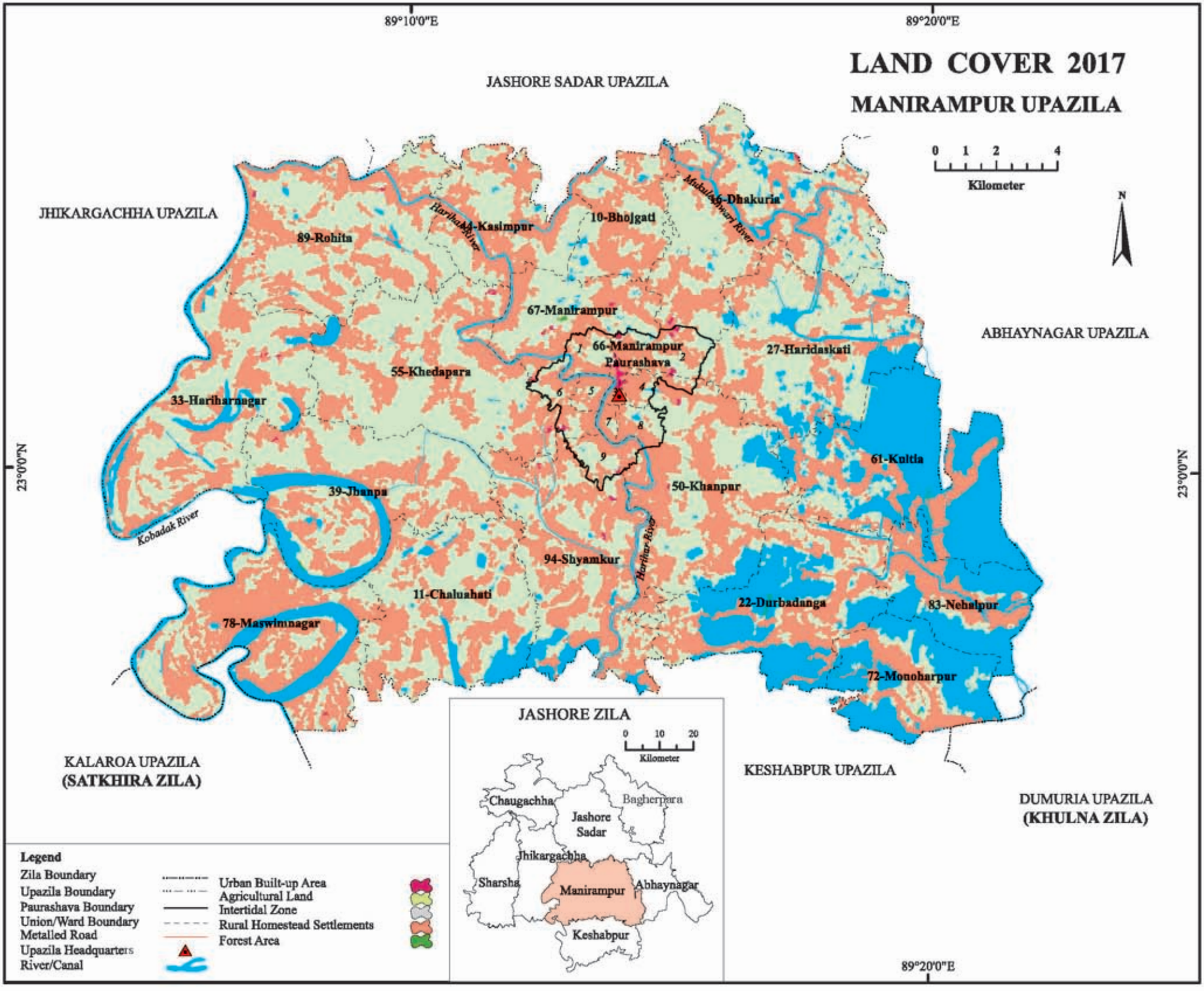
Source: Stat4Dev Project, BBS, 2021



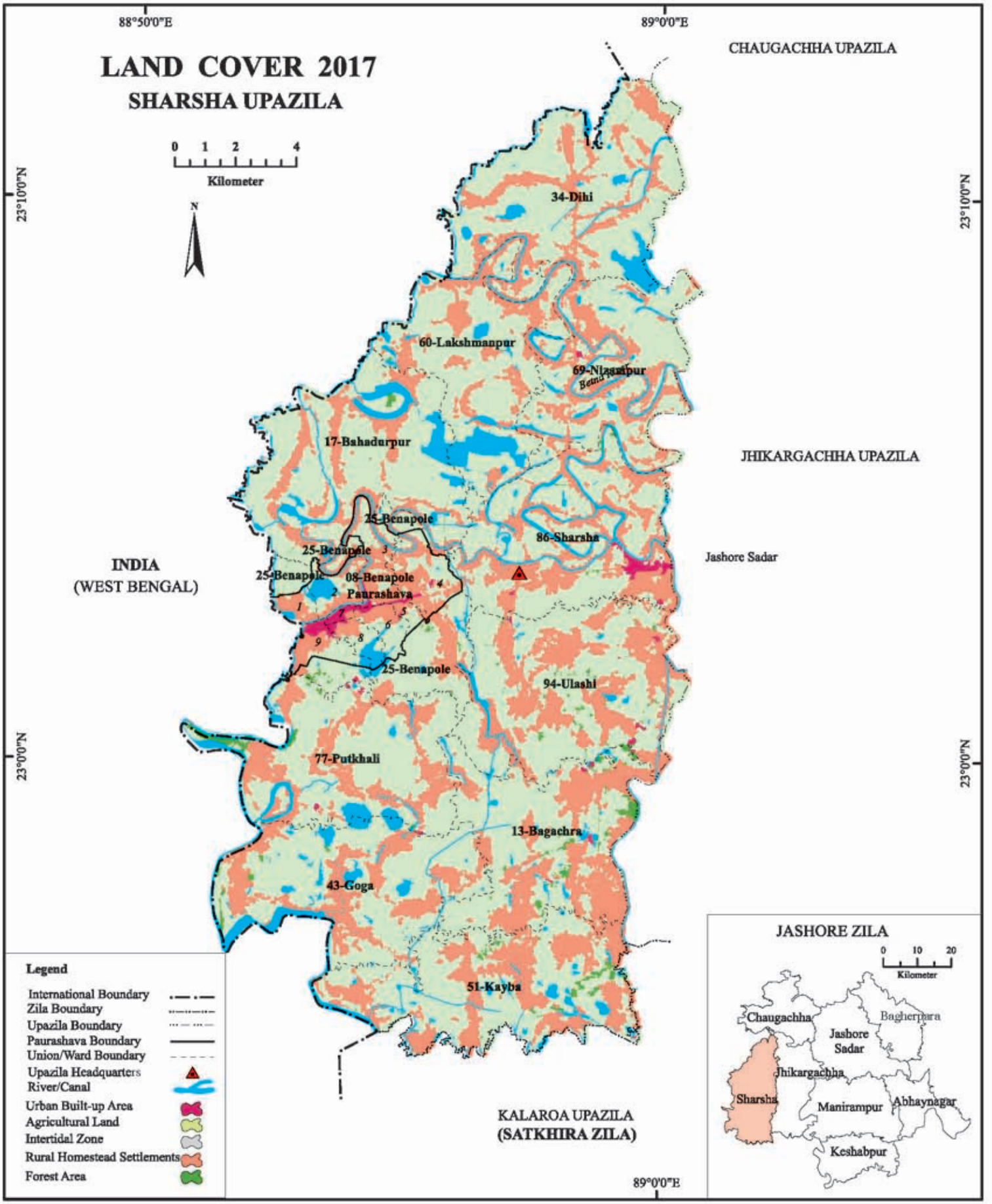
Source: Stat4Dev Project, BBS, 2021



Source: Stat4Dev Project, BBS, 2021



Source: Stat4Dev Project, BBS, 2021



Source: Stat4Dev Project, BBS, 2021

3.6 Education

The literacy rate of population 7 years and above is shown in Table 3.5. It is noticed that the literacy rate for both male and female in the district, urban and rural areas have been increasing since 1991 but the increasing rates are found insignificant during the inter-census period 2001-2011. The increasing rates show that there are only 5.23, 3.23 and 7.56 percentage increase in the district, 3.99, 2.46 and 6.11 percentage increase in urban and 5.05, 2.95 and 7.42 percentage increase in rural area for both male and female respectively during the decade under reference.

Table 3.5: Literacy rate of population 7 years and above by sex and residence, 1991-2011 (In percentage)

Years	Zila			Urban			Rural		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
2011	56.52	59.38	53.65	69.41	72.94	65.65	53.54	56.12	50.99
2001	51.29	56.15	46.09	65.42	70.48	59.54	48.49	53.17	43.57
1991	33.40	41.00	25.10	53.30	66.9	44.70	30.20	37.70	22.10

Source: Zila Report, Population and Housing Census 2011, BBS.

Table 3.6: Distribution of various educational establishments in Jashore district.

Types of Institutes	Abhaynagar	Bagherpara	Chaugachha	Jashore Sadar	Jhikorgachha	Keshabpur	Manirampur	Sharsha	Total
Government Primary School	63	63	61	140	72	72	120	73	**662**
Registered Primary School	45	35	72	77	53	78	138	44	**542**
Non-govt. Primary School	2	2	2	10	1	4	4	8	**33**
Kindergarten School	12	6	7	60	12	15	22	26	**160**
NGO School	22	22	11	31	75	22	119	42	**344**
Government Secondary School	0	0	0	2	0	0	2	0	**4**
Non-government Secondary School	52	38	47	102	48	73	116	33	**509**

Government College	0	0	0	3	0	0	0	0	**3**
Non-government College	10	8	10	16	8	12	14	8	**86**
Madrasah	20	34	21	48	32	53	70	32	**310**
Kawmi Madrasah	7	5	5	31	3	14	4	4	**73**
Ebtedayee Madrasah	3	2	1	5	13	6	15	4	**49**
Technical and Vocational Institution	0	0	0	7	1	0	1	0	**9**

Source: District Statistics, 2011, BBS.

3.7 Health facilities

The mass population mainly depends on government health complex and all type of health facilities are concentrated in Sadar area. Besides this, there are few union health & family welfare centres and private clinic facilities. The following table shows the health facility types and their number in the district.

Table 3.7: Number of health facilities in Jashore district.

Types of Institutes	**Abhaynagar**	**Bagherpara**	**Chaugachha**	**Jashore Sadar**	**Jhikorgachha**	**Keshabpur**	**Manirampur**	**Sharsha**	**Total**
Government Health Complex	1	1	1	1	1	1	1	1	**8**
Private Hospital/Clinic	8	3	4	27	6	10	4	11	**73**
Diagnostic Centre	7	1	3	22	2	2	1	0	**38**
Health Centre	8	8	12	15	10	8	16	11	**88**

Source: Directorate General of Health Services, Mohakhali, Dhaka, 2020

3.8 Transport

Palanquin, horse carriage and bullock cart were the traditional transports once found in the rural area of the district. These means of transport are either extinct or nearly extinct. Now-a-days, all the upazilas are connected to the district headquarters by metalled roads. Bus, minibus, three wheelers ply over the zila. All the upazilas is also connected to the district headquarters by railway.

Table 3.8: Distribution of road types (km) of different upazilas of Jashore district.

Upazila/ City Corporation	Metalled road	Semi metalled road	Unmetalled (kacha) road	Total	Total railway (all broad gage, meter gage & duel gage)	Water way in monsoon (River + Canal)	Water way round the Year (River + Canal)
Abhaynagar	113	106	488	707	13	53	25
Bagherpara	135	70	482	687	0	29	12
Chaugachha	176	47	400	623	0	0	0
Jessore Sadar	194	260	806	1260	55	0	0
Jhikargachha	207	18	683	908	14	0	0
Keshabpur	147.9	80.8	602.2	830.9	0		0
Manirampur	300.3	122	973.97	1396.27	0	0	0
Sharsha	180.6	85.9	856.6	1123.1	13	0	0
Total	**1453.8**	**789.7**	**5291.77**	**7535.27**	**95**		**37**

Source: District Statistics, 2011, BBS.

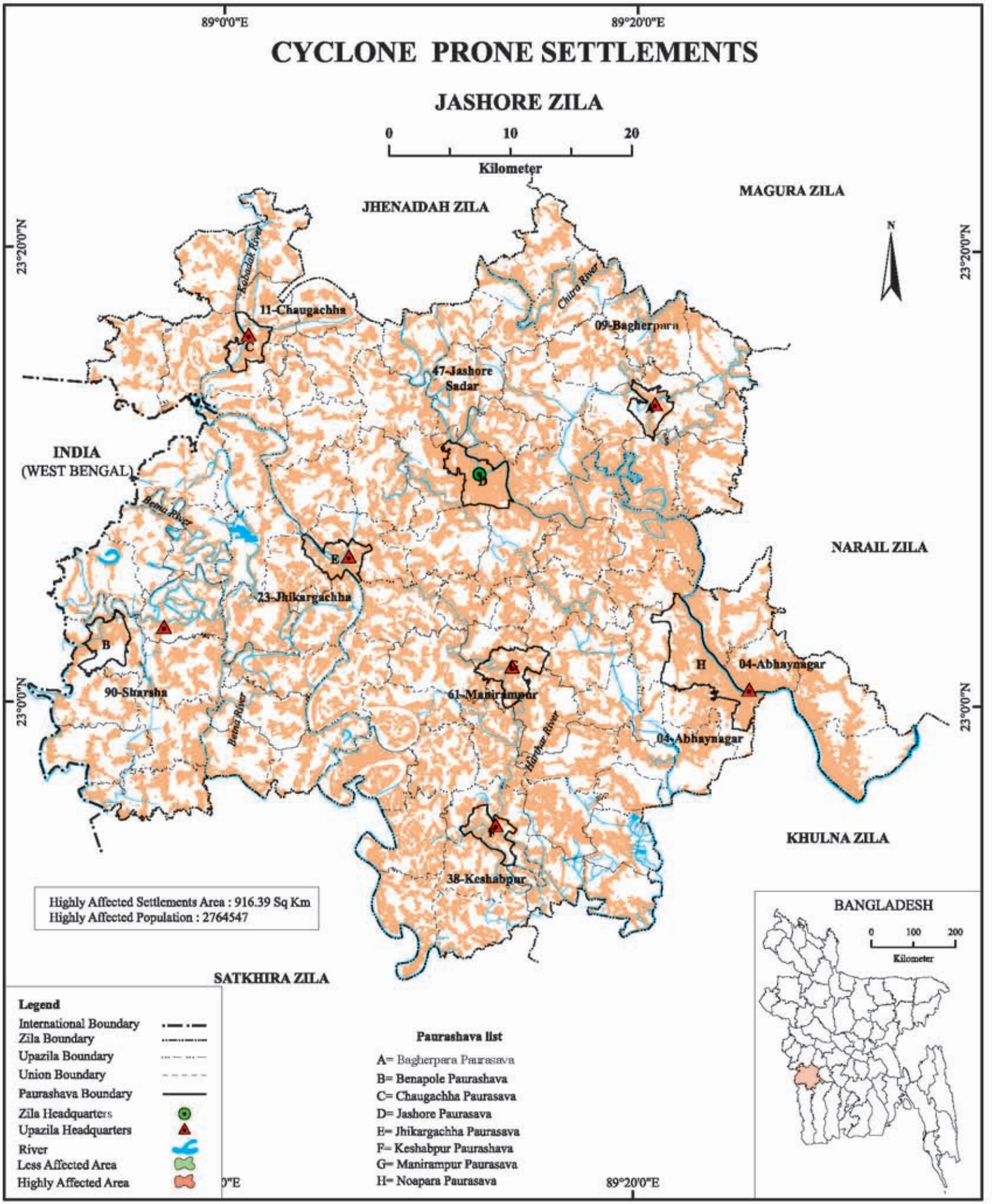
3.9 Cyclone shelters

There are no cyclone shelter in Jashore district.

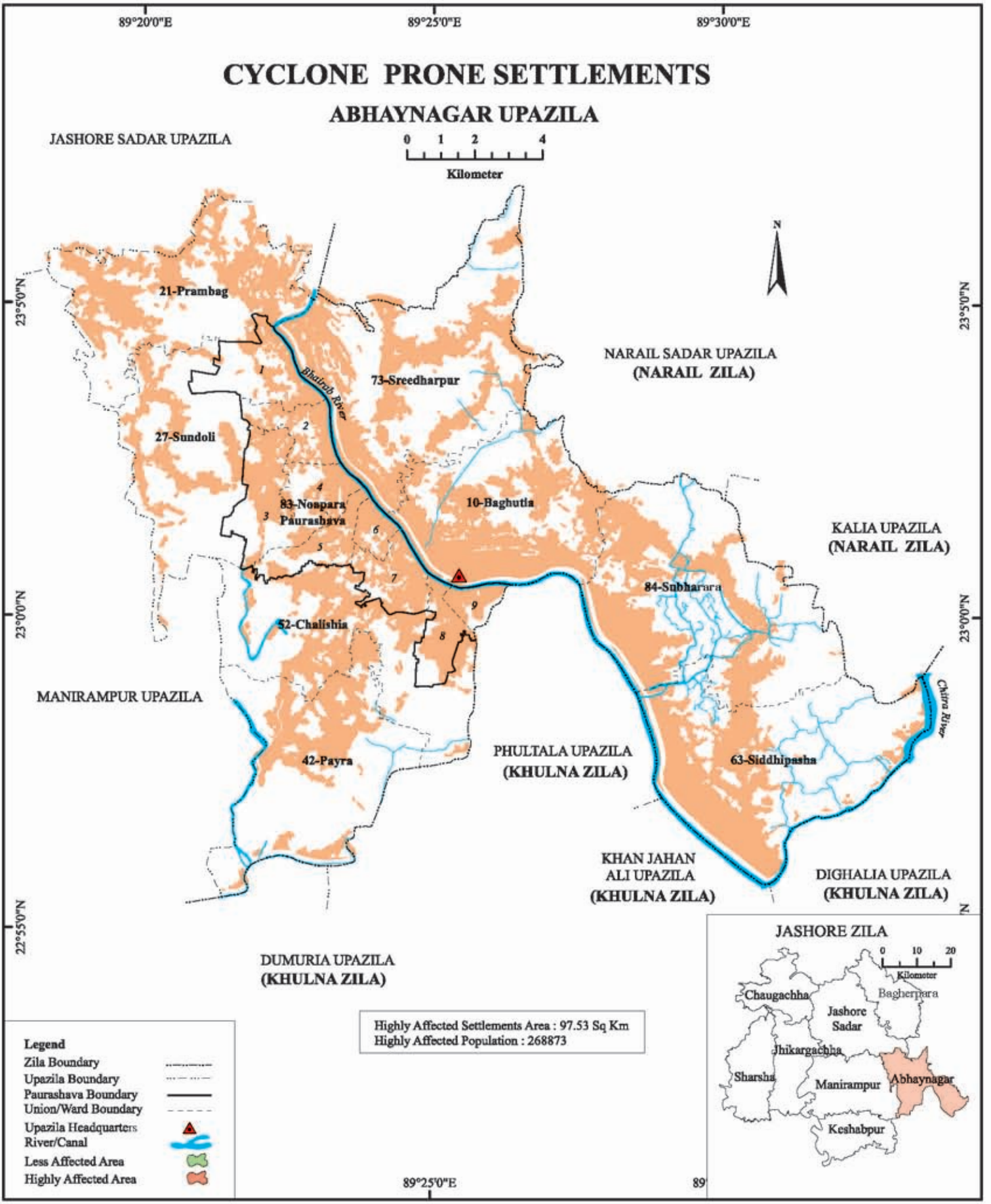
Chapter 4

Hazard Assessment and Mapping

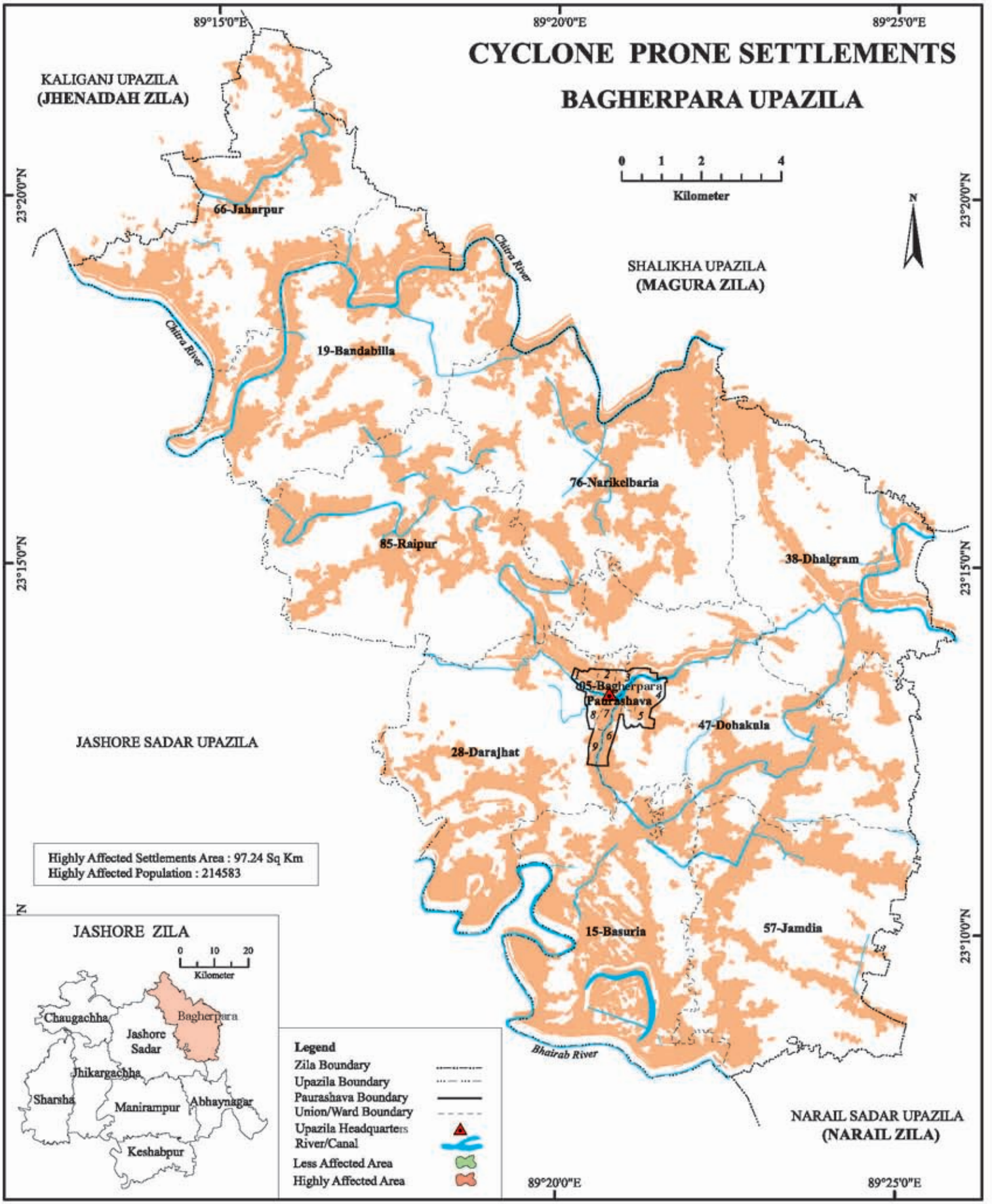
Cyclone Prone Area Map



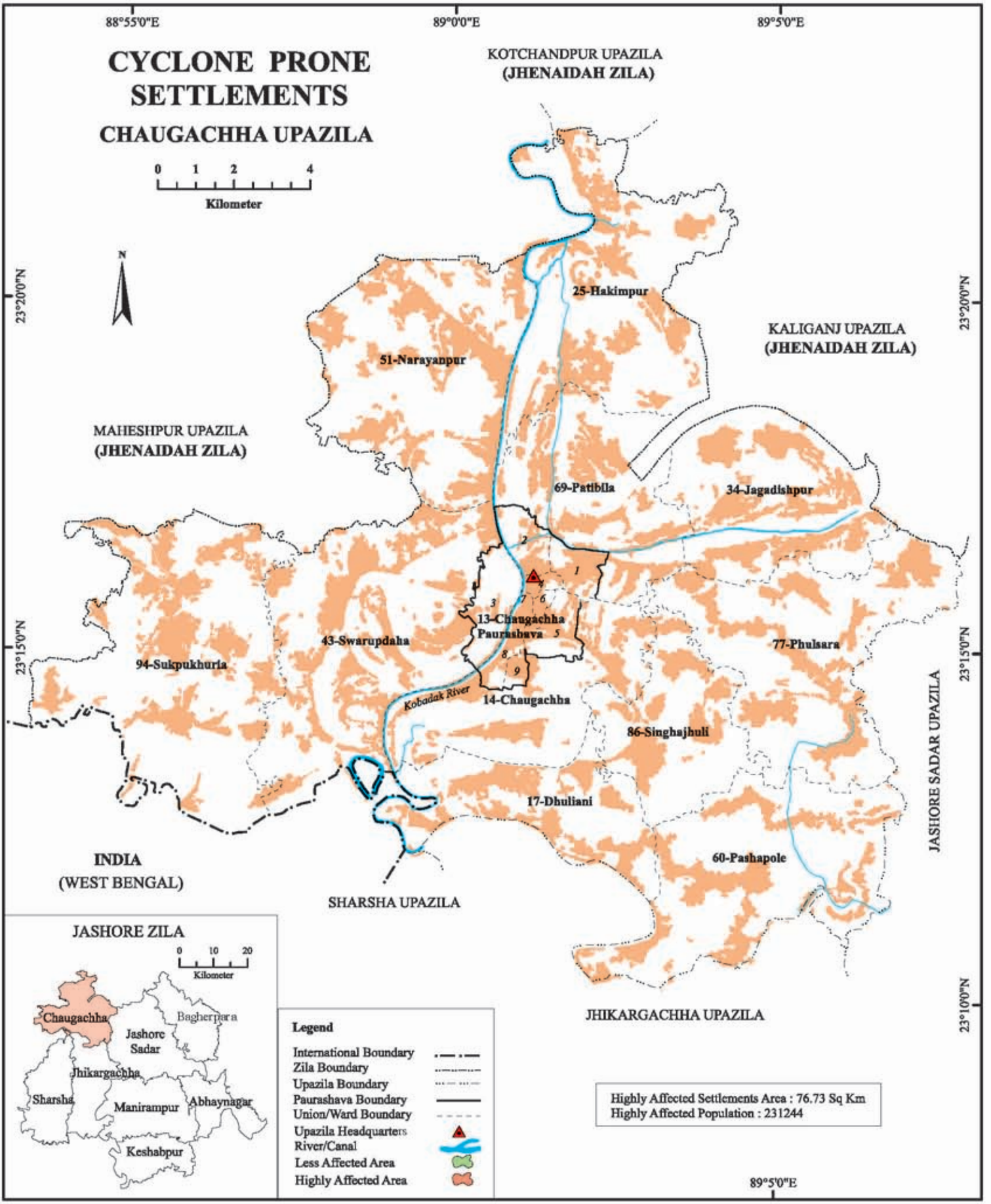
Source: Field Servey, Stat4Dev Project, BBS, 2021



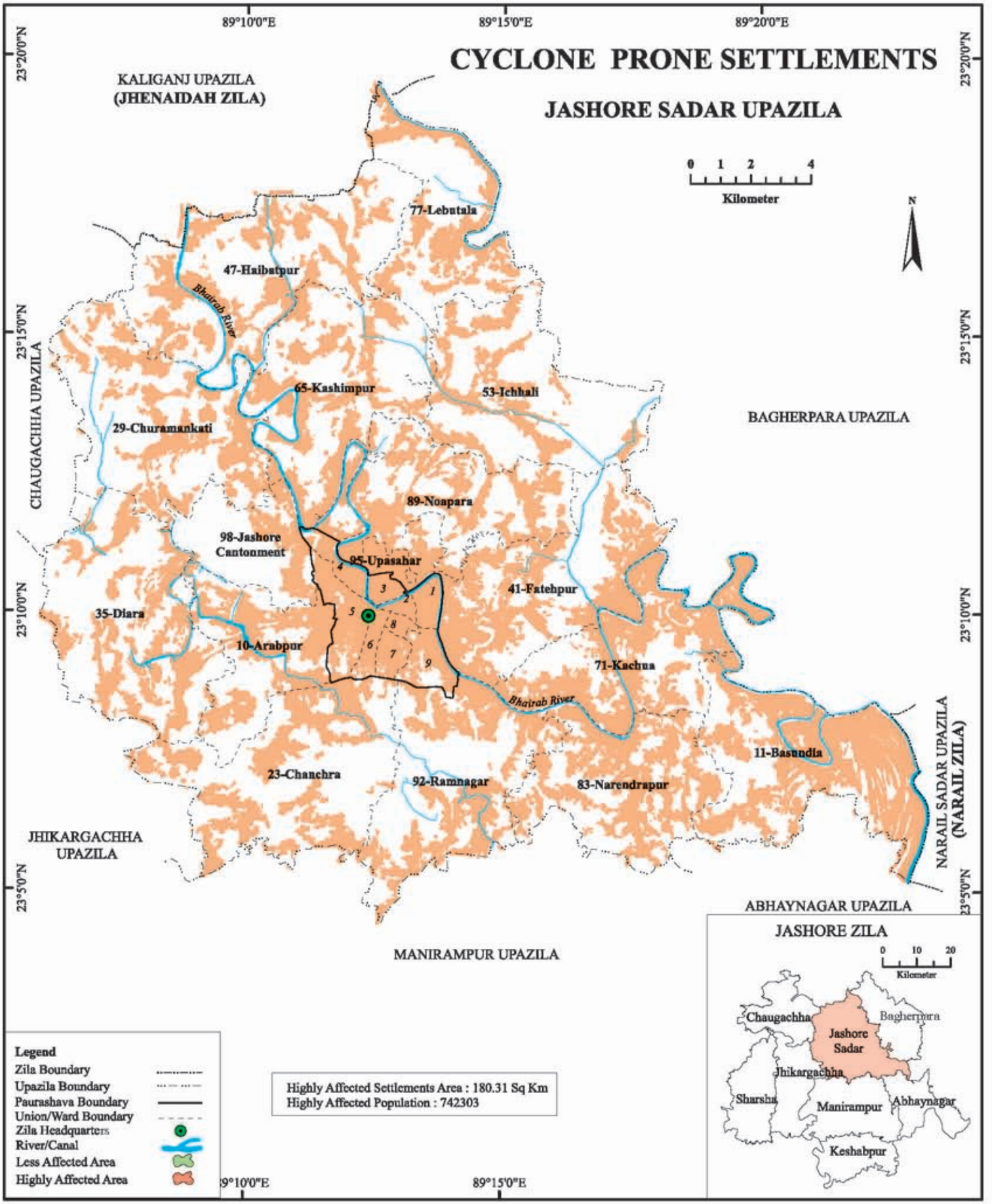
Source: Field Servey, Stat4Dev Project, BBS, 2021



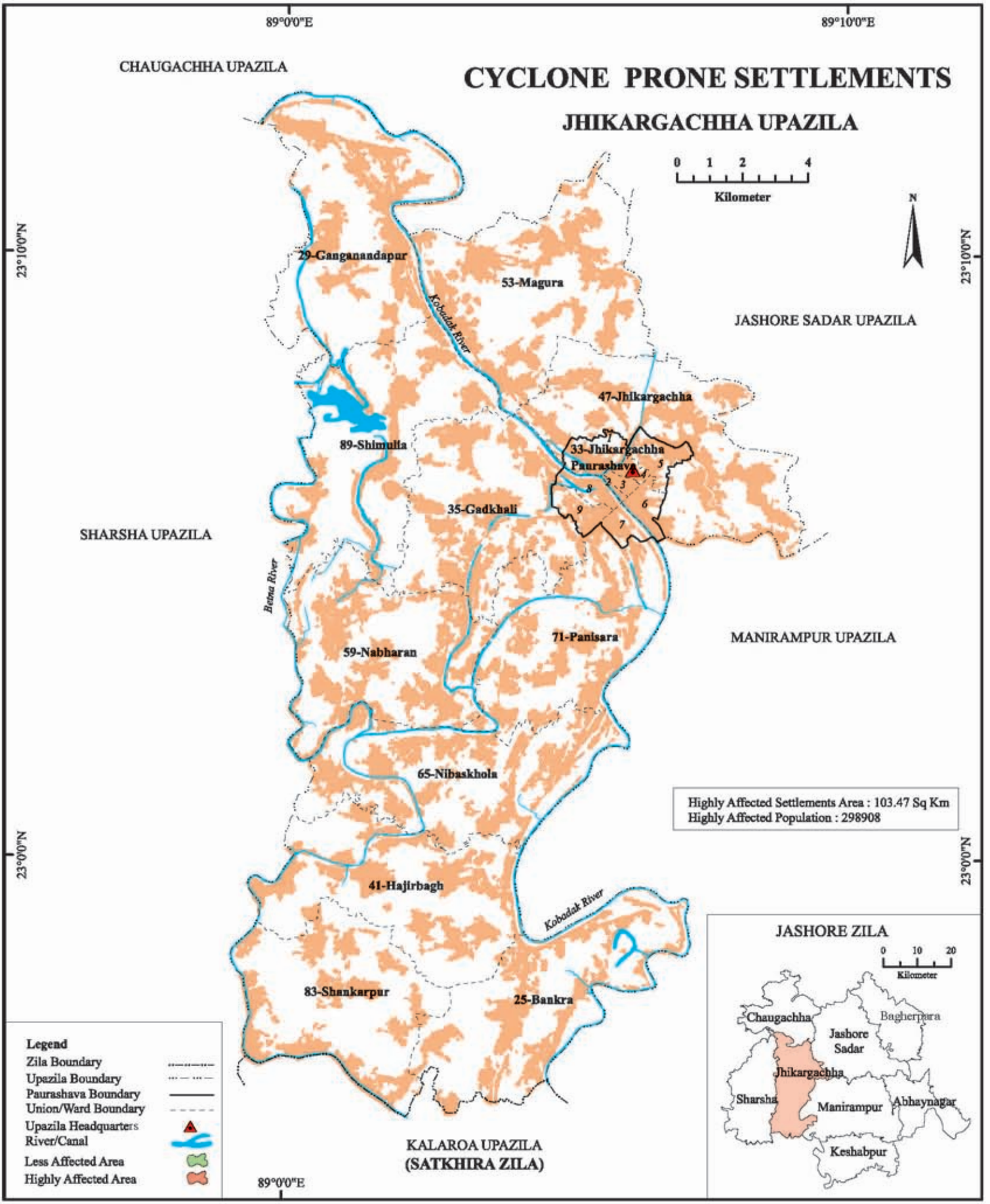
Source: Field Servey, Stat4Dev Project, BBS, 2021



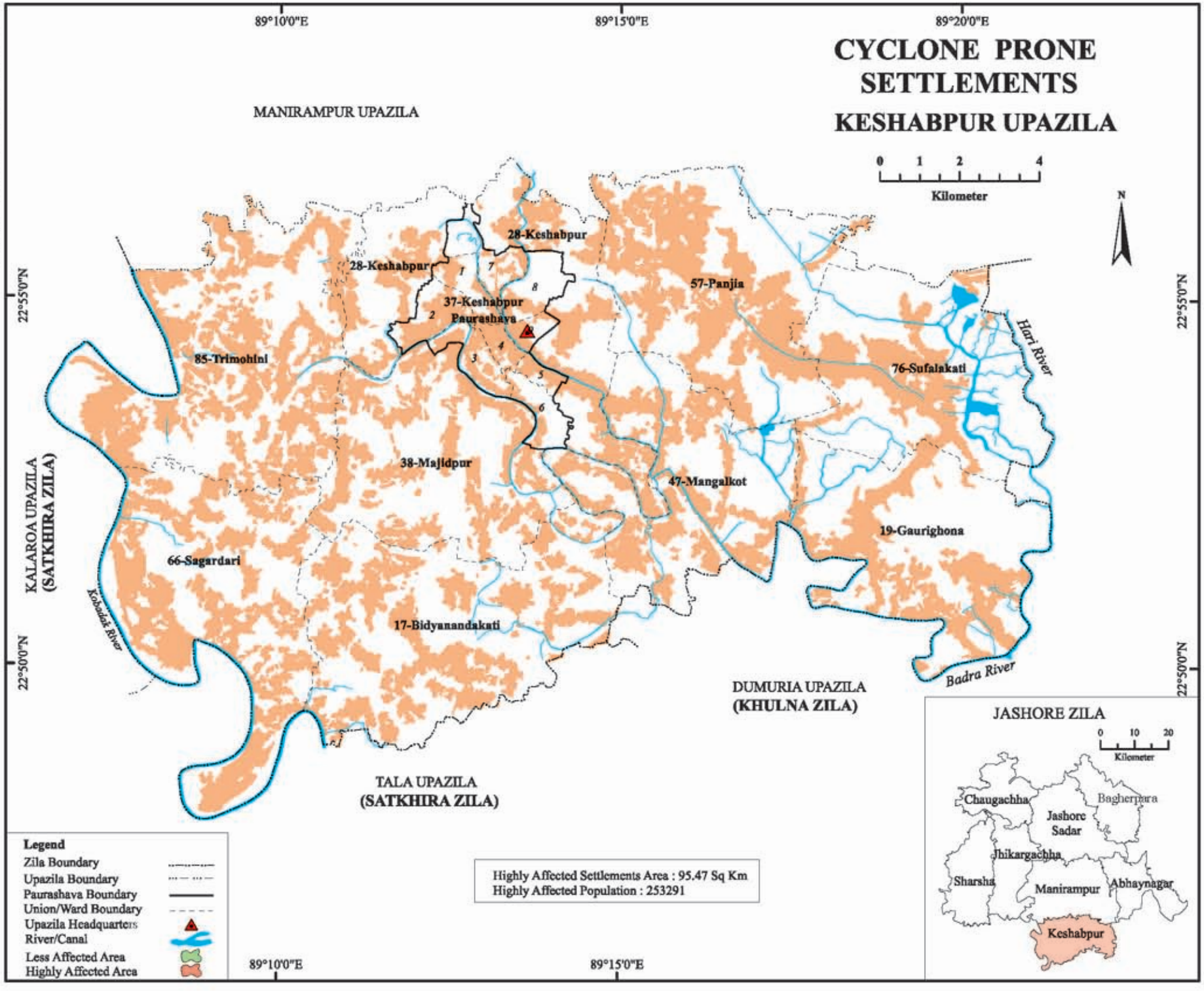
Source: Field Servey, Stat4Dev Project, BBS, 2021



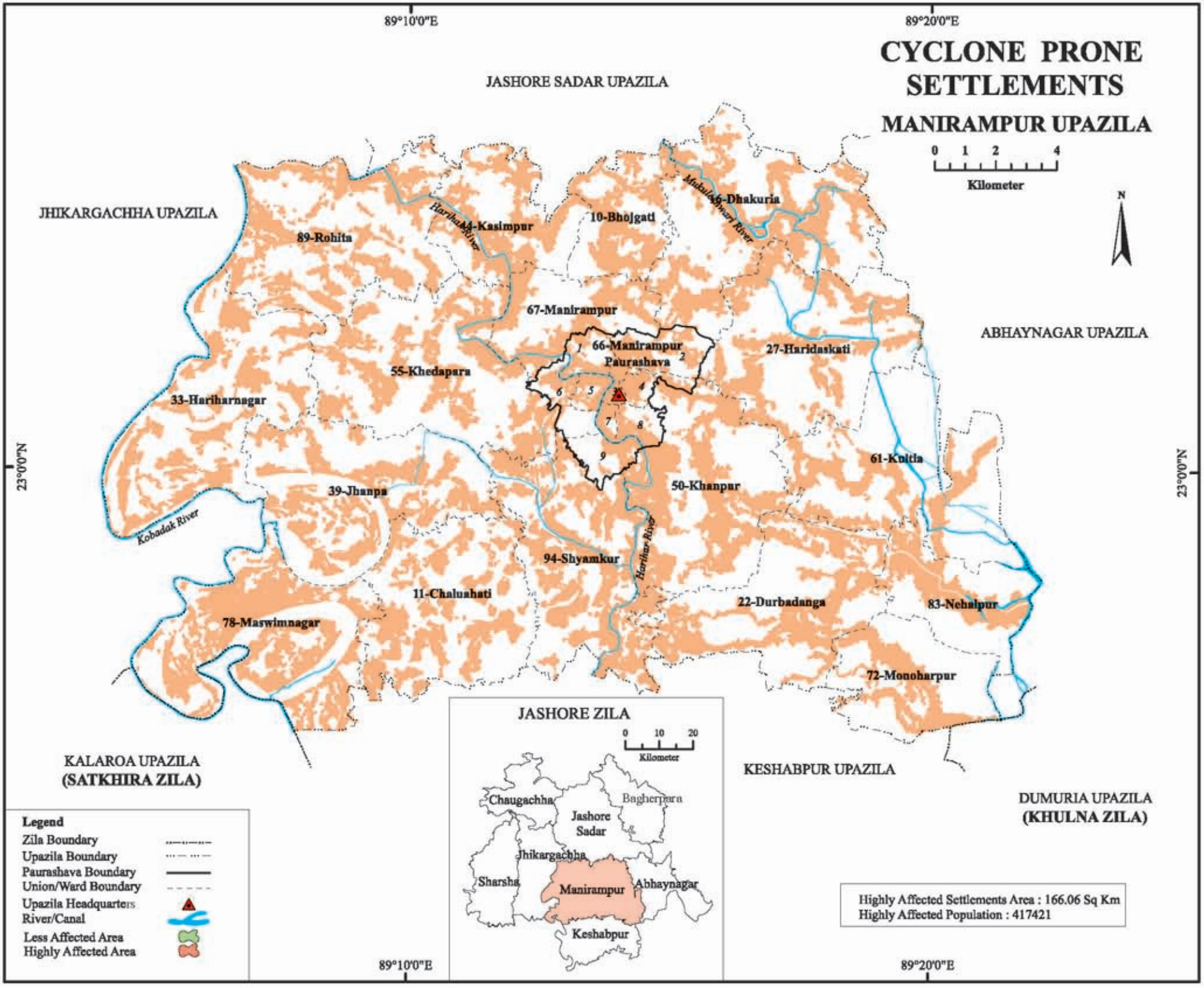
Source: Field Servey, Stat4Dev Project, BBS, 2021

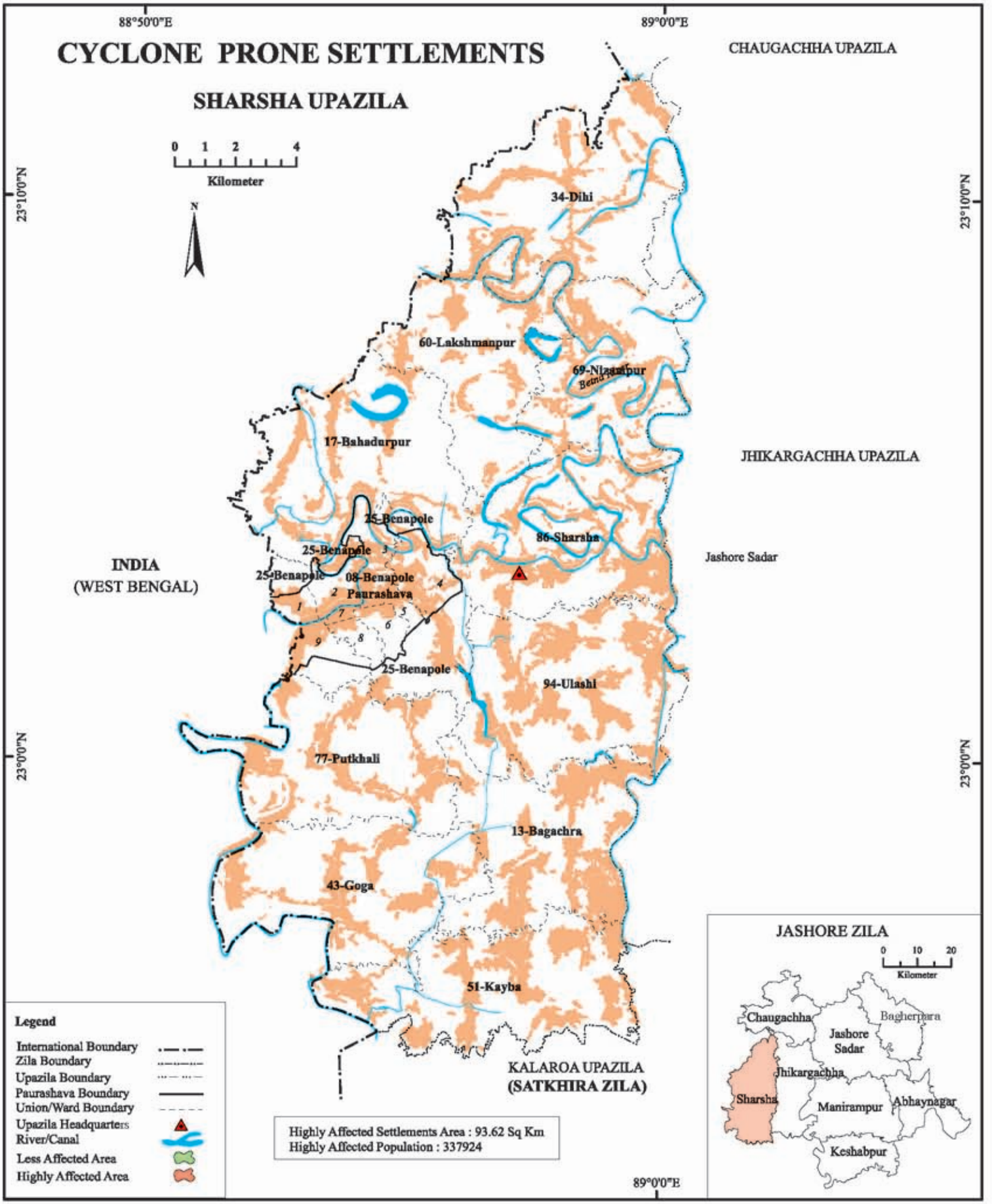


Source: Field Servey, Stat4Dev Project, BBS, 2021



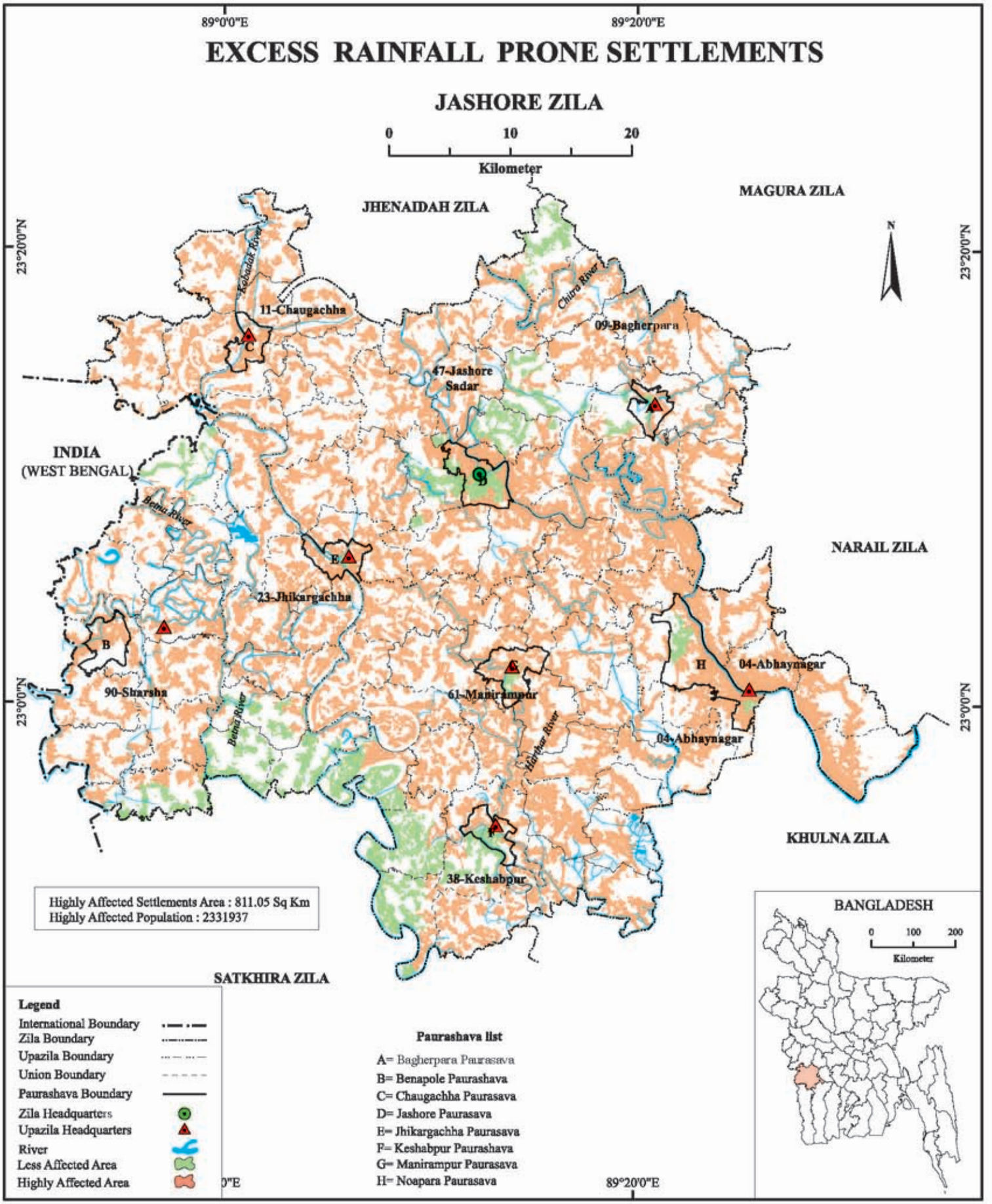
Source: Field Survey, StatiDev Project, BBS, 2021


CYCLONE PRONE SETTLEMENTS
MANIRAMPUR UPAZILA
Source: Field Servey, Stat4Dev Project, BBS, 2021
89°10'0"E
89°20'0"E
23°0'0"N
JASHORE SADAR UPAZILA
JHIKARGACHHA UPAZILA
ABHAYNAGAR UPAZILA
KALAROA UPAZILA
(SATKHIRA ZILA)
KESHABPUR UPAZILA
DUMURIA UPAZILA
(KHULNA ZILA)
0 1 2 4
Kilometer
N
89-Rohita
4-Kasimpur
10-Bhojgati
9-Dhakuria
67-Manirampur
66-Manirampur Paurashava
27-Haridaskati
55-Khedapara
33-Hariharnagar
61-Kaitia
50-Khanpur
39-Jhanpa
94-Shyamkur
11-Chaluahati
22-Durbadanga
83-Nehalpur
78-Maswimnagar
72-Monoharpur
Harihar River
Kobadak River
Mukteshwari River
JASHORE ZILA
0 10 20
Kilometer
Chaugachha
Bagherpara
Jashore Sadar
Jhikargachha
Sharsha
Manirampur
Abhaynagar
Keshabpur
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union/Ward Boundary
Upazila Headquarters
River/Canal
Less Affected Area
Highly Affected Area
Highly Affected Settlements Area : 166.06 Sq Km
Highly Affected Population : 417421

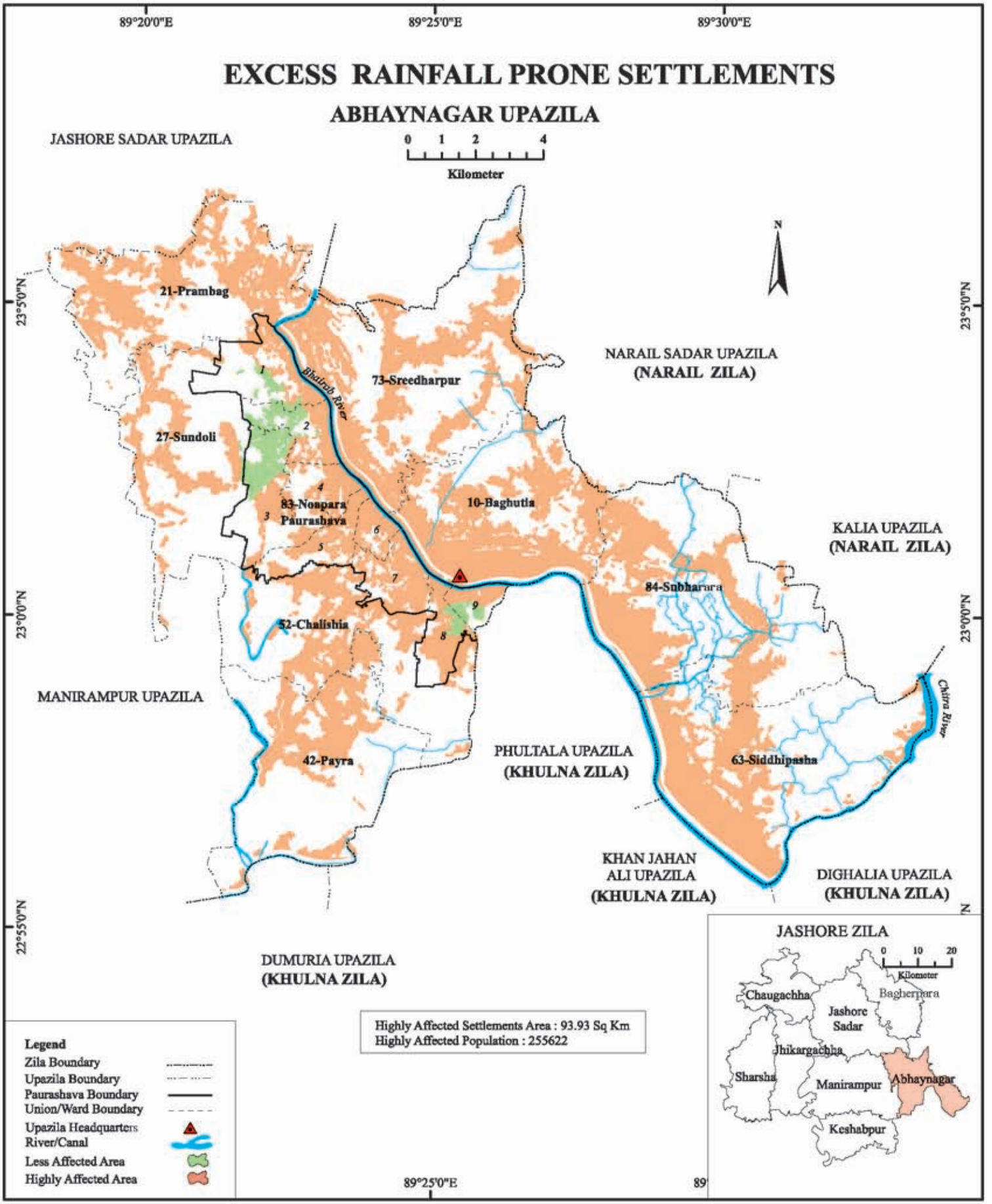


Source: Field Servey, Stat4Dev Project, BBS, 2021

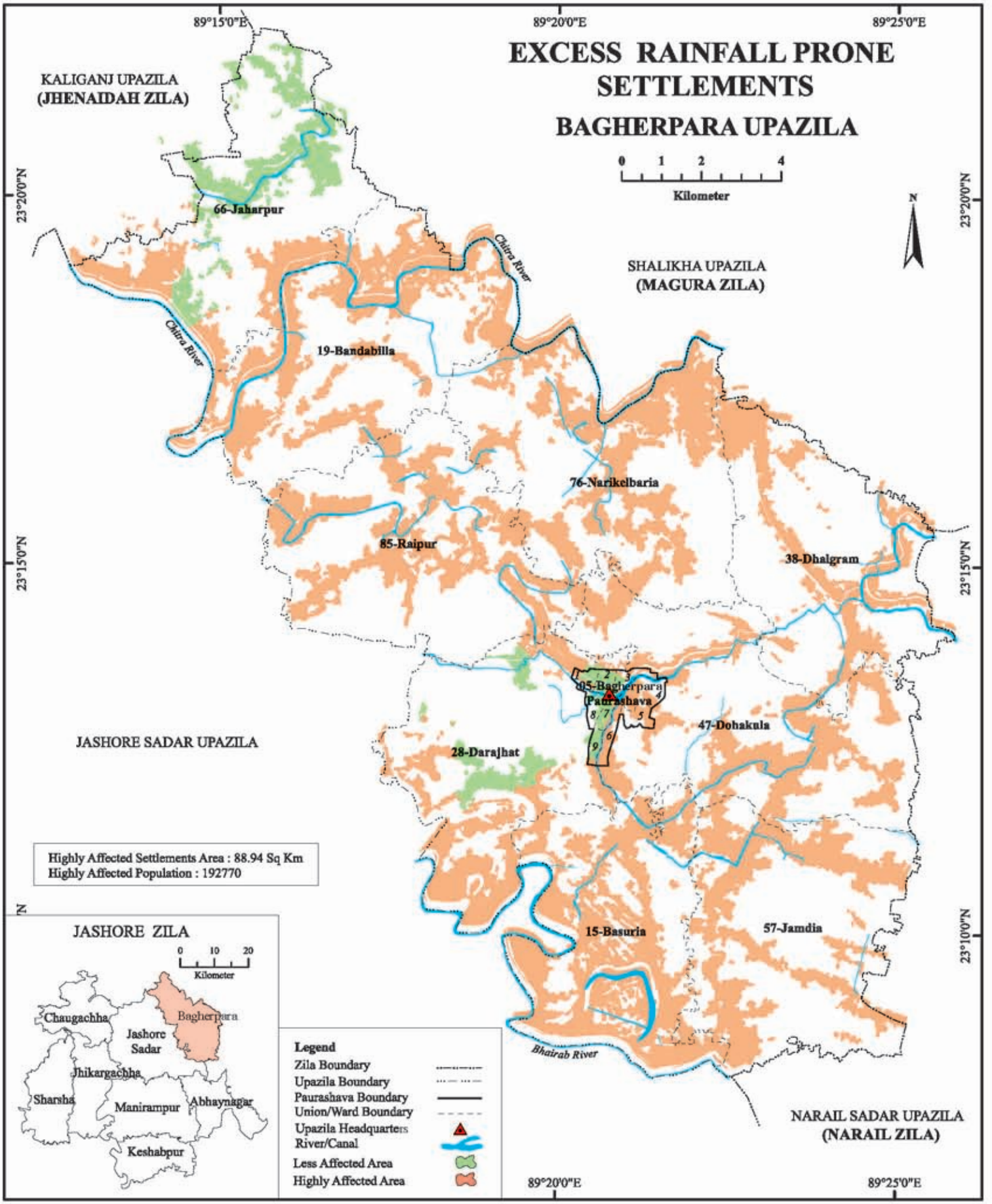
Excess Rainfall Prone Area Map



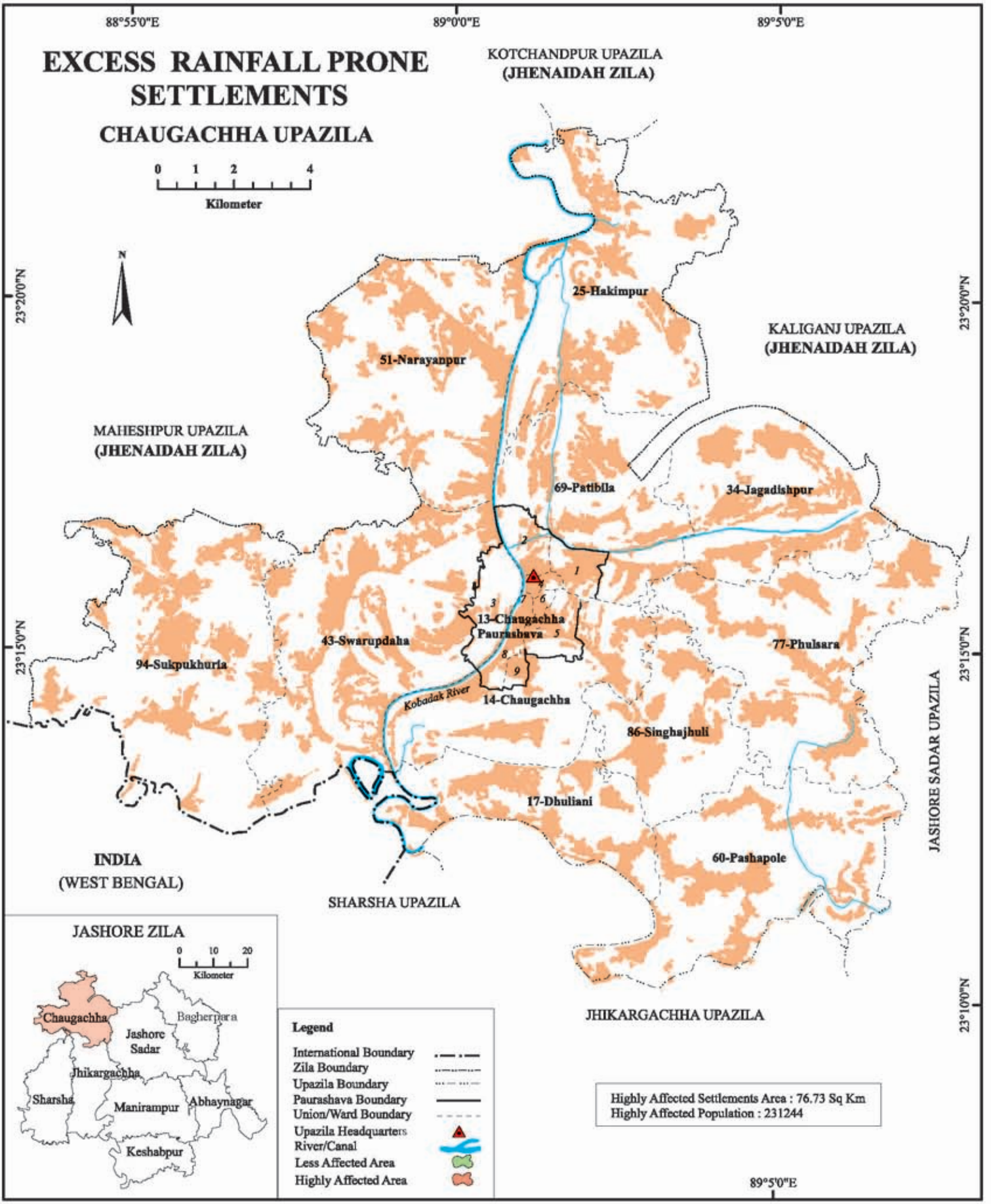
Source: Field Servey, Stat4Dev Project, BBS, 2021



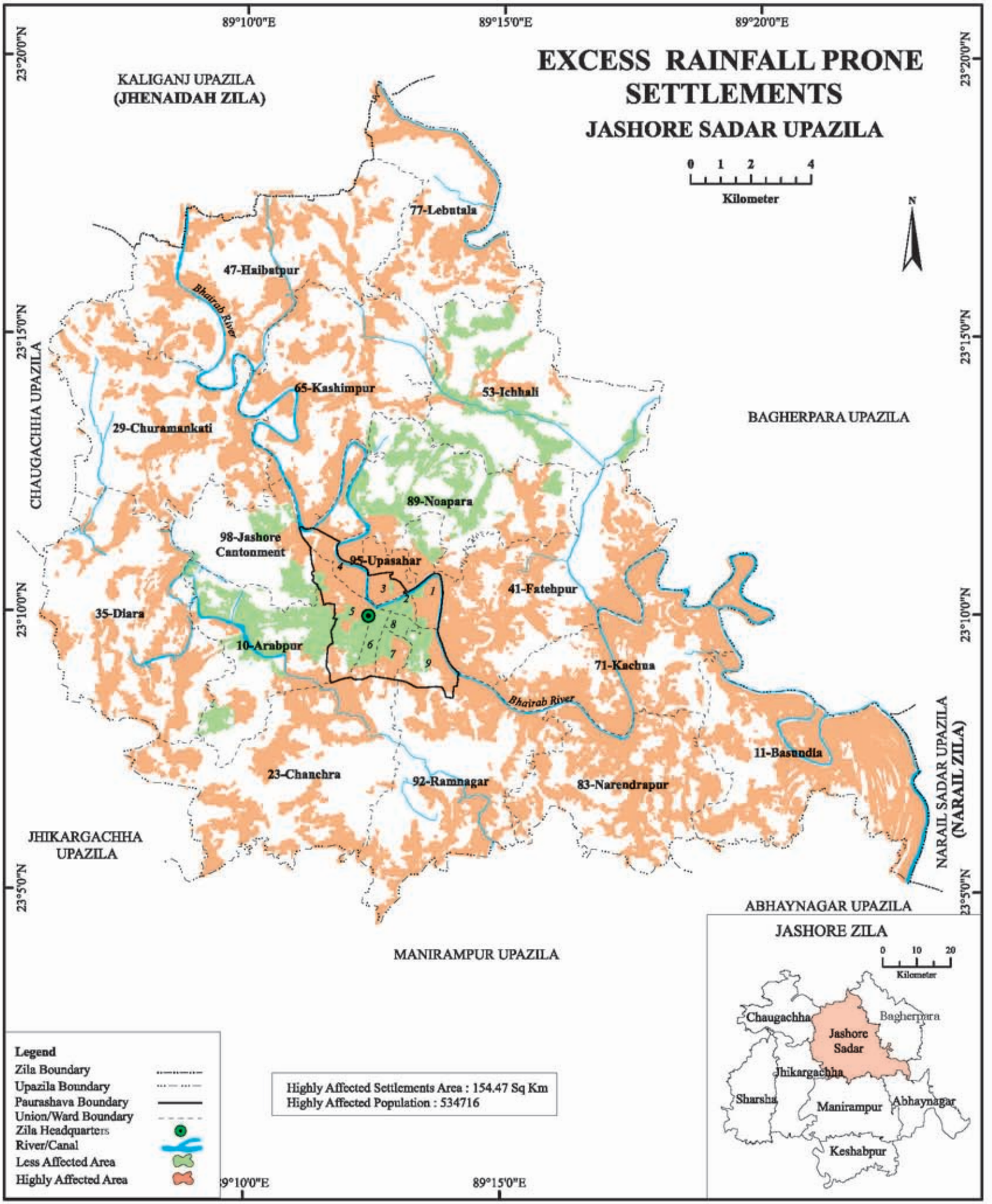
Source: Field Servey, Stat4Dev Project, BBS, 2021



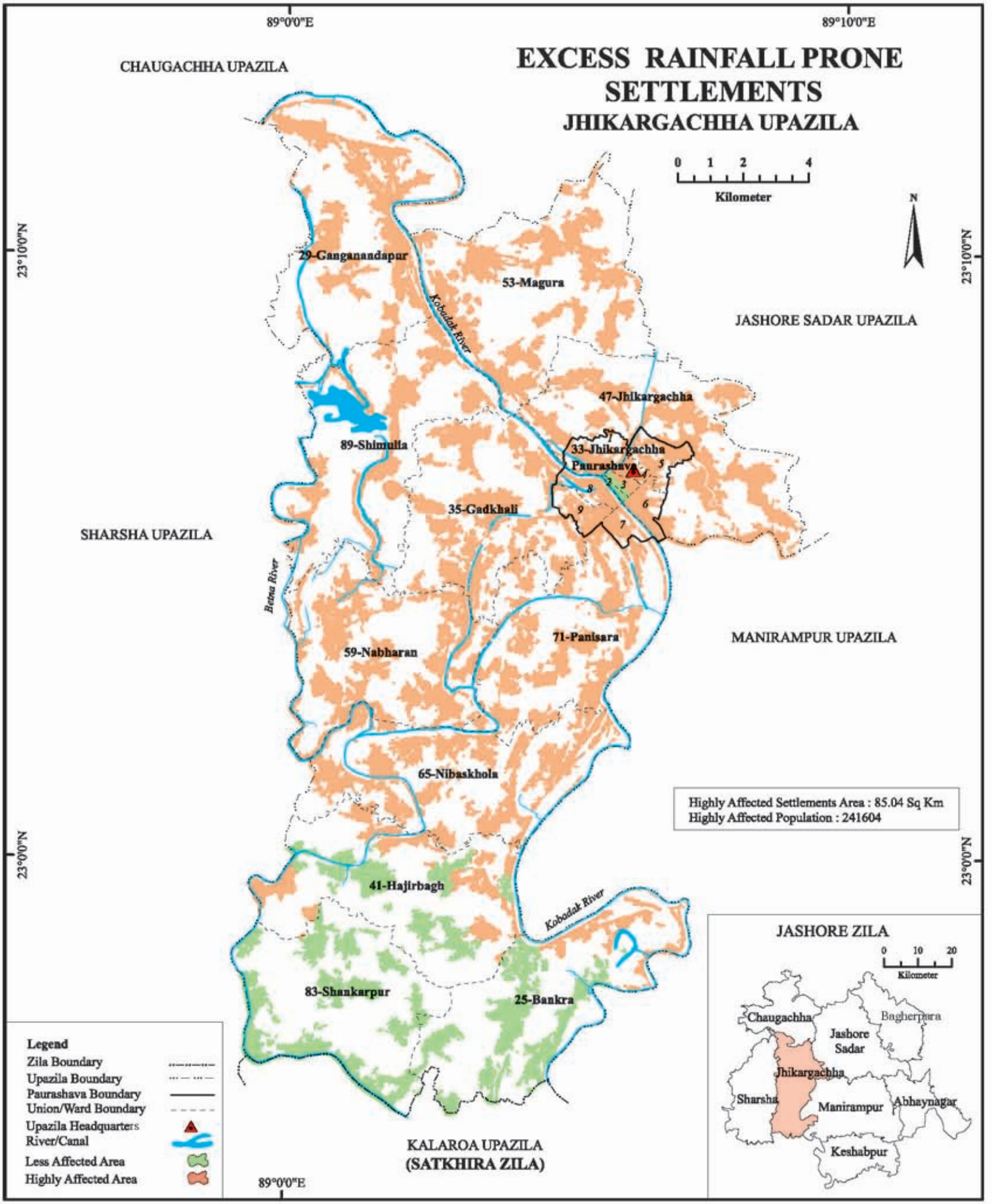
Source: Field Servey, Stat4Dev Project, BBS, 2021



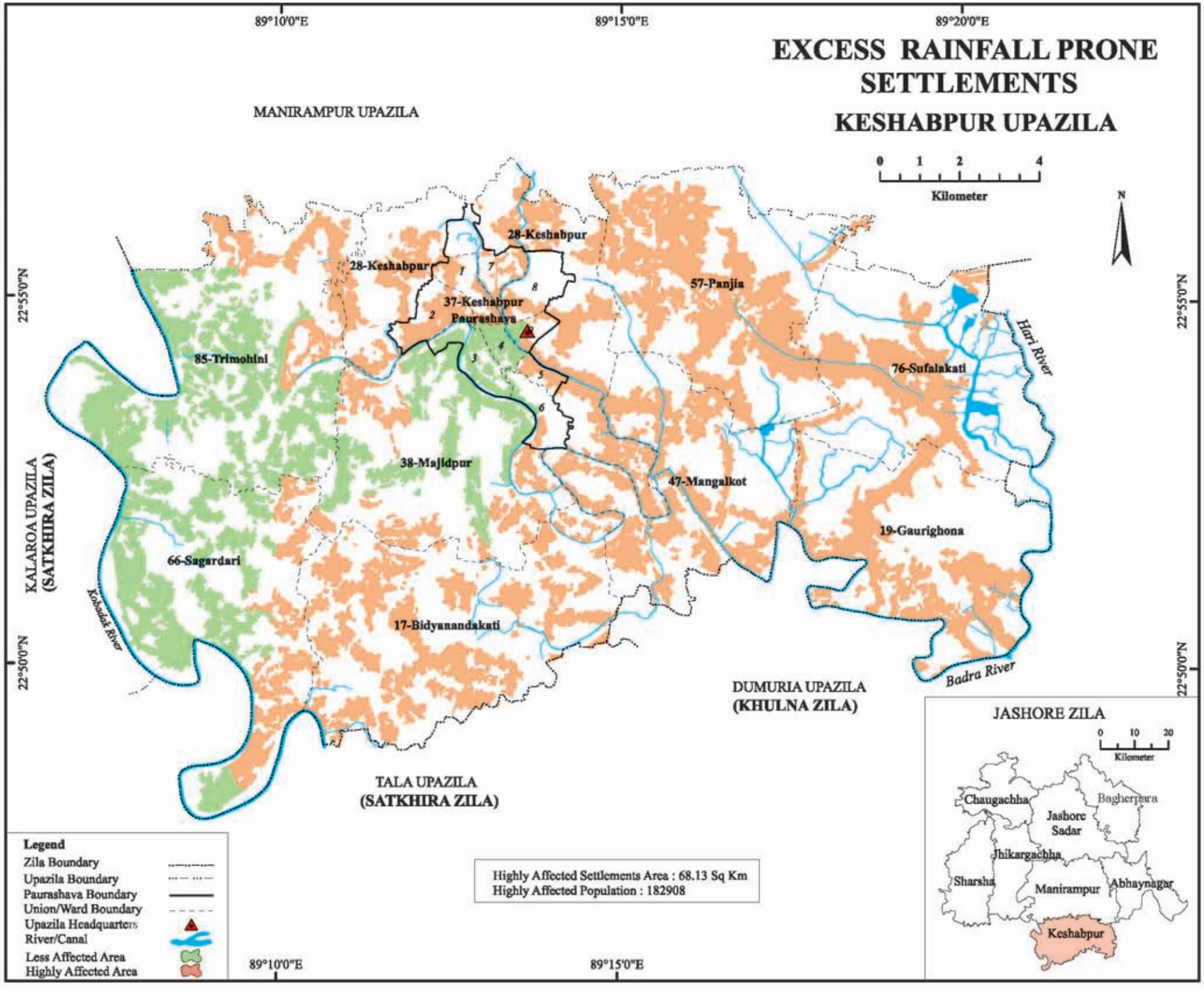
Source: Field Servey, Stat4Dev Project, BBS, 2021



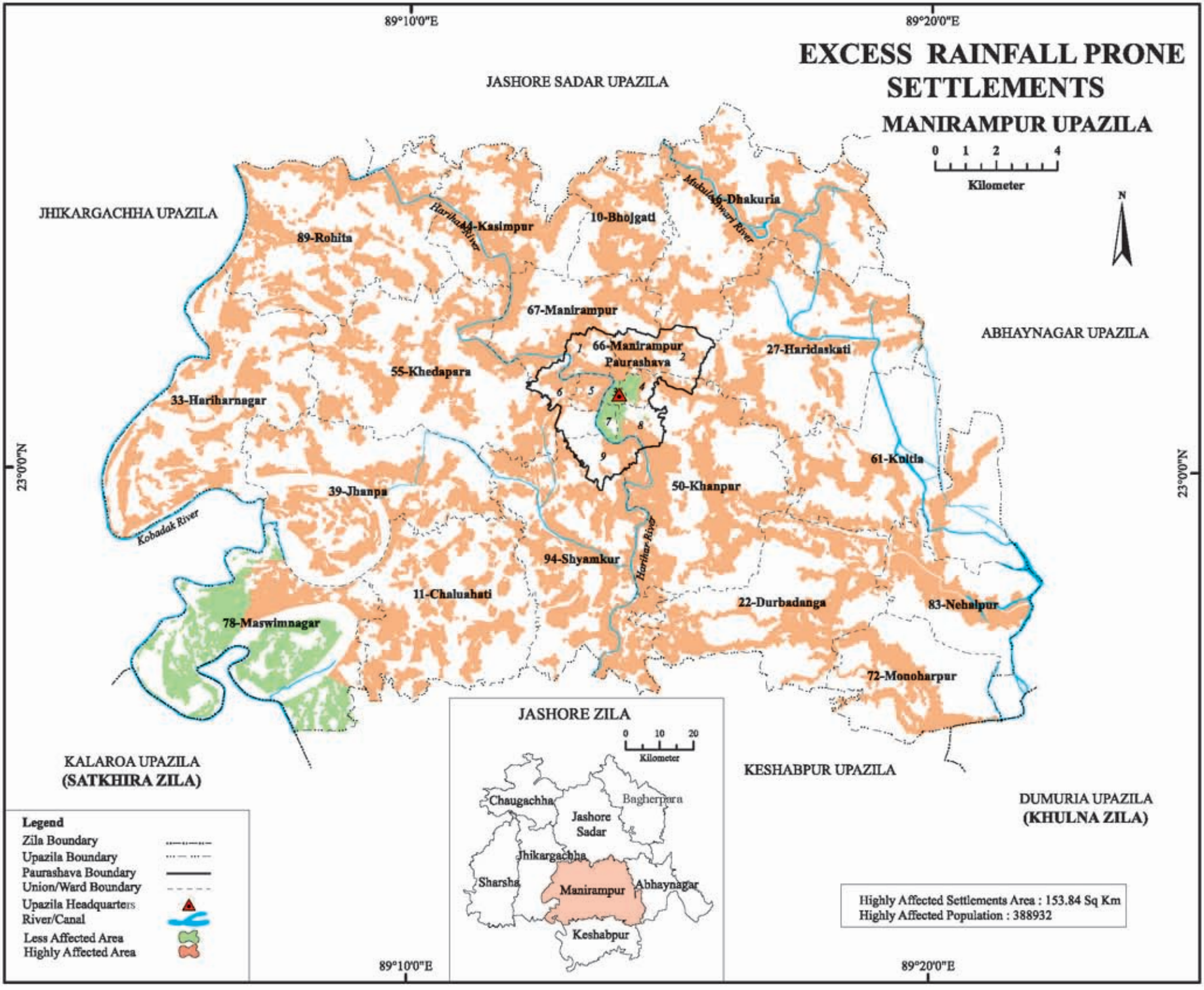
Source: Field Servey, Stat4Dev Project, BBS, 2021



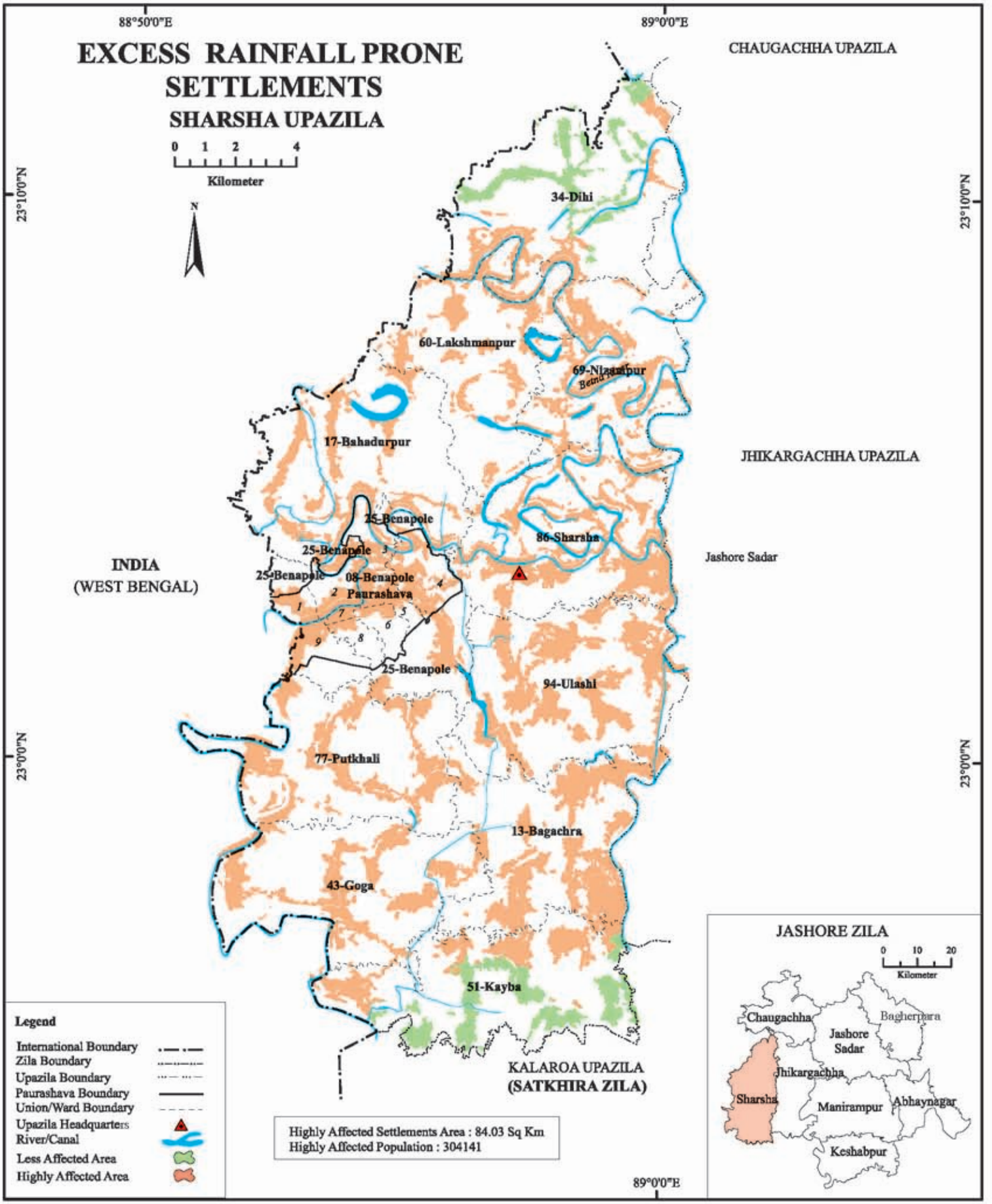
Source: Field Servey, Stat4Dev Project, BBS, 2021



Source: Field Survey, StatHDev Project, BBS, 2021

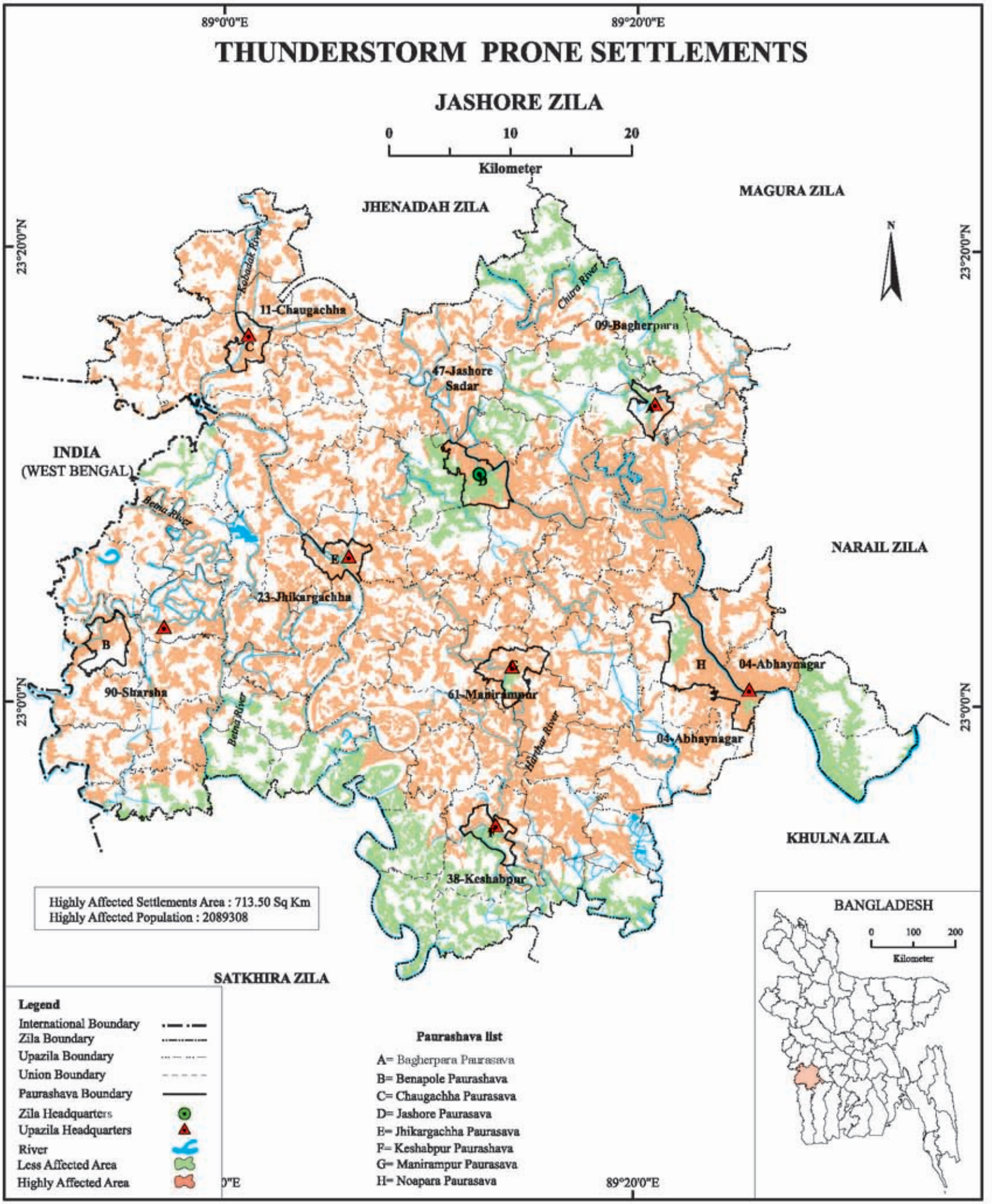


Source: Field Servey, Stat4Dev Project, BBS, 2021

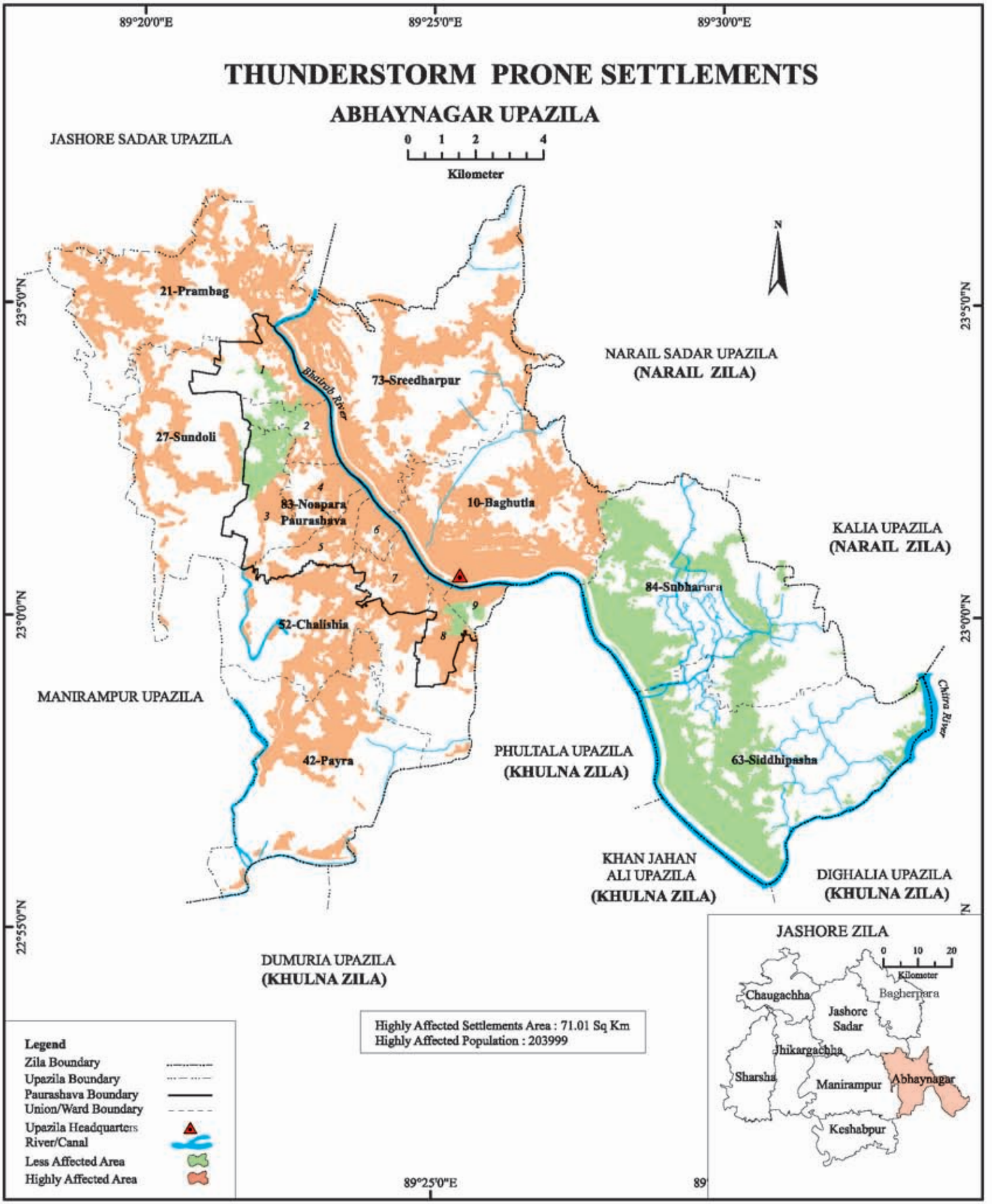


Source: Field Servey, Stat4Dev Project, BBS, 2021

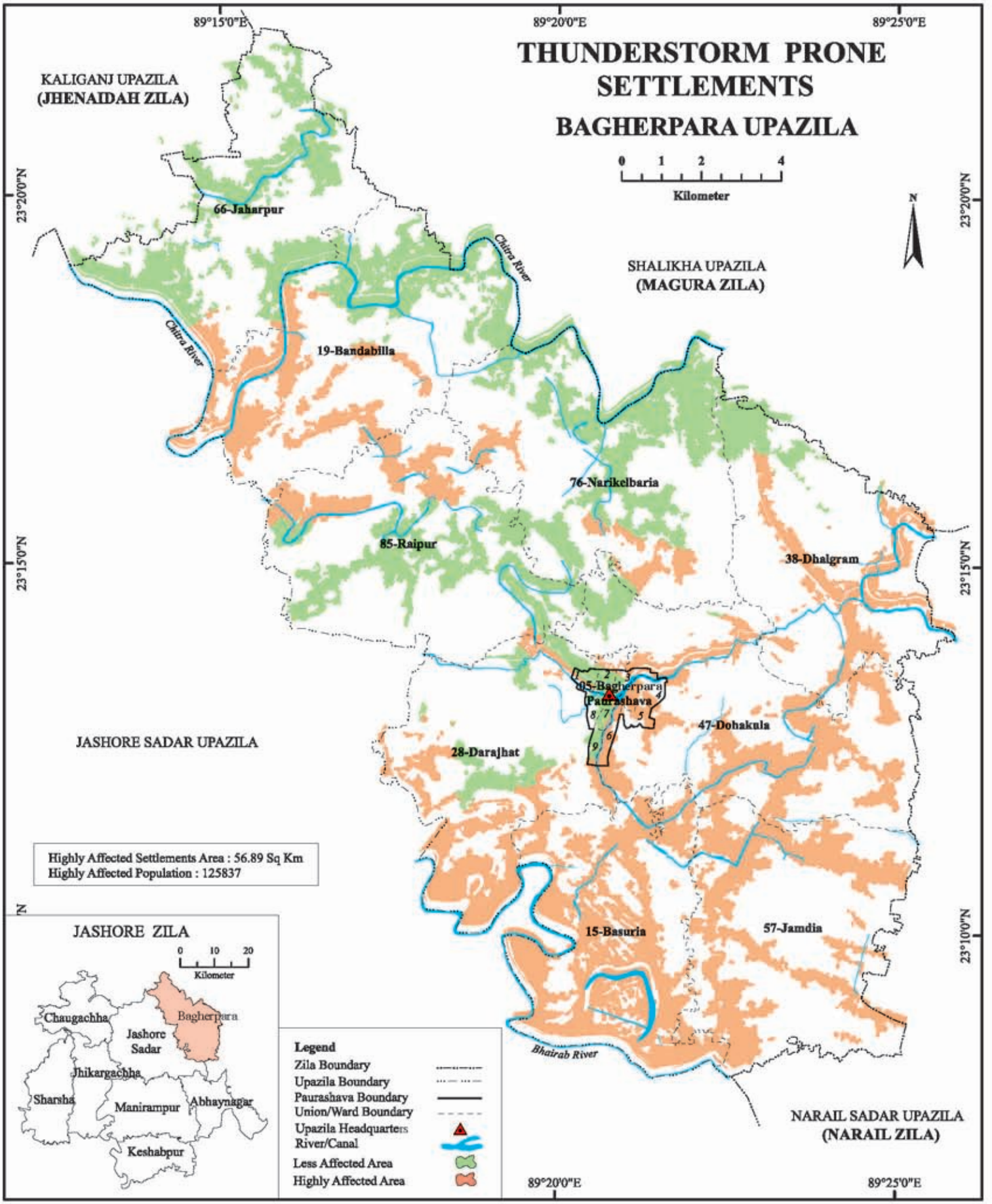
Thunderstorm Prone Area Map



Source: Field Servey, Stat4Dev Project, BBS, 2021



Source: Field Servey, Stat4Dev Project, BBS, 2021



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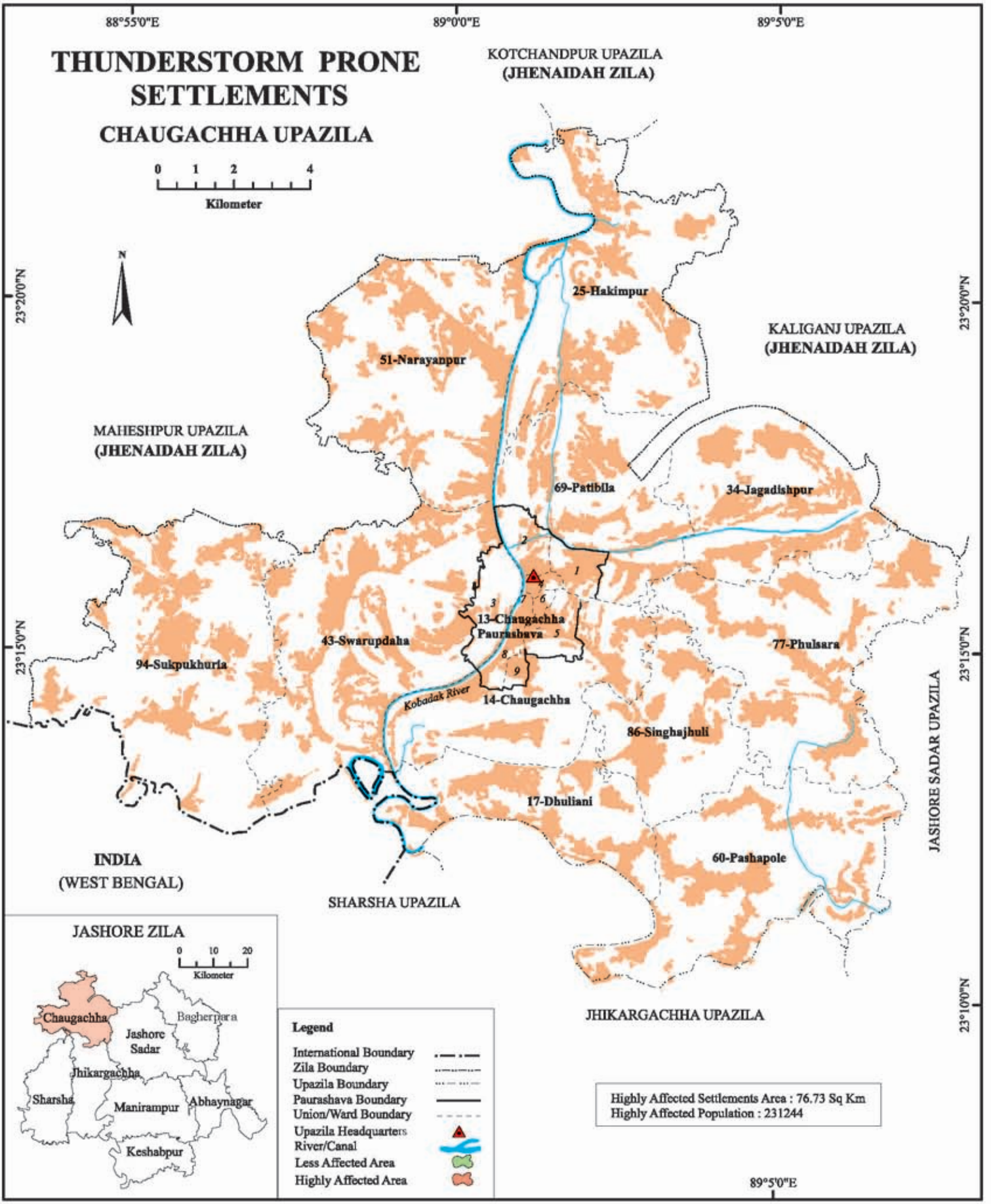
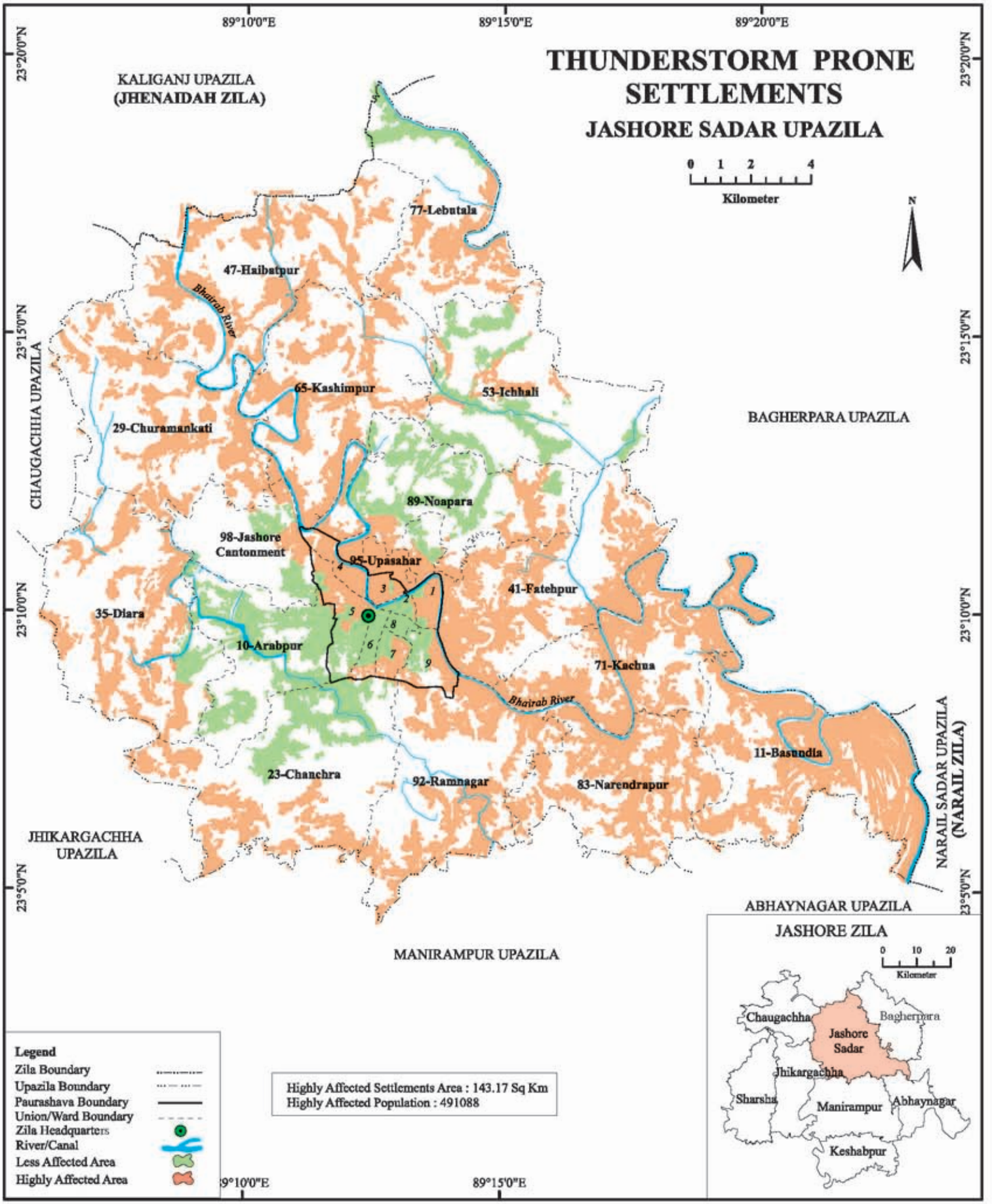


Source: Field Servey, Stat4Dev Project, BBS, 2021



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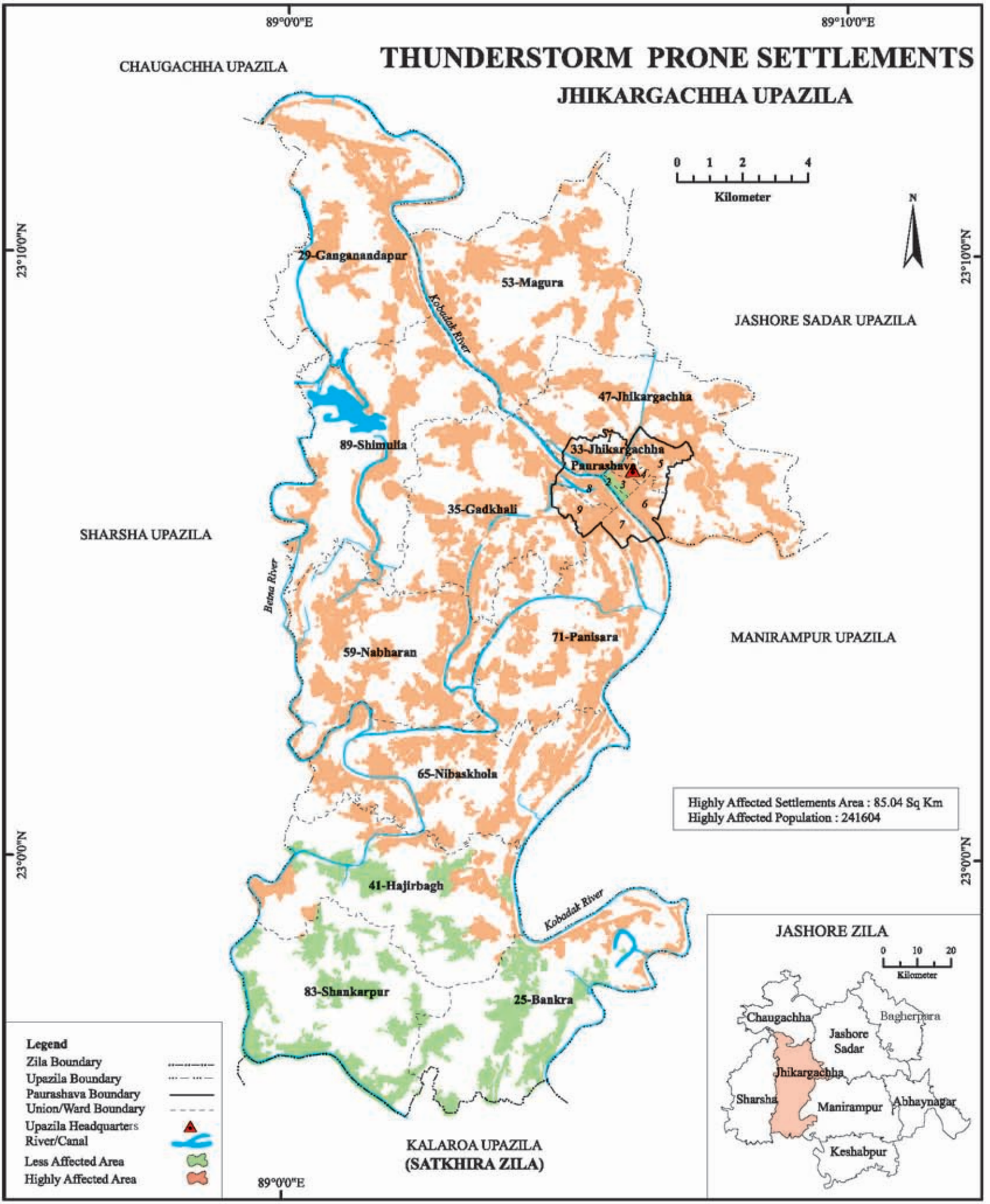
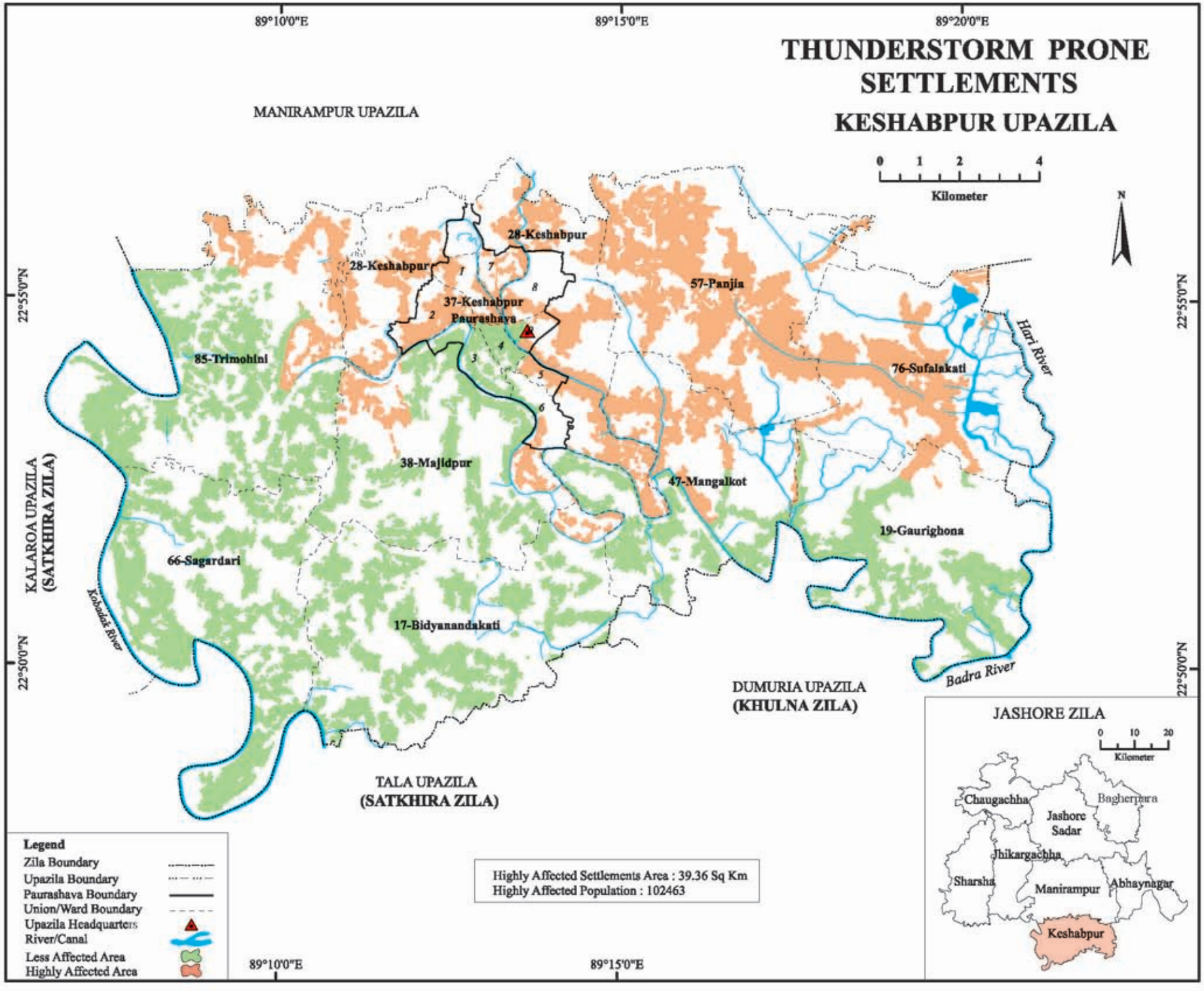


Source: Field Servey, Stat4Dev Project, BBS, 2021



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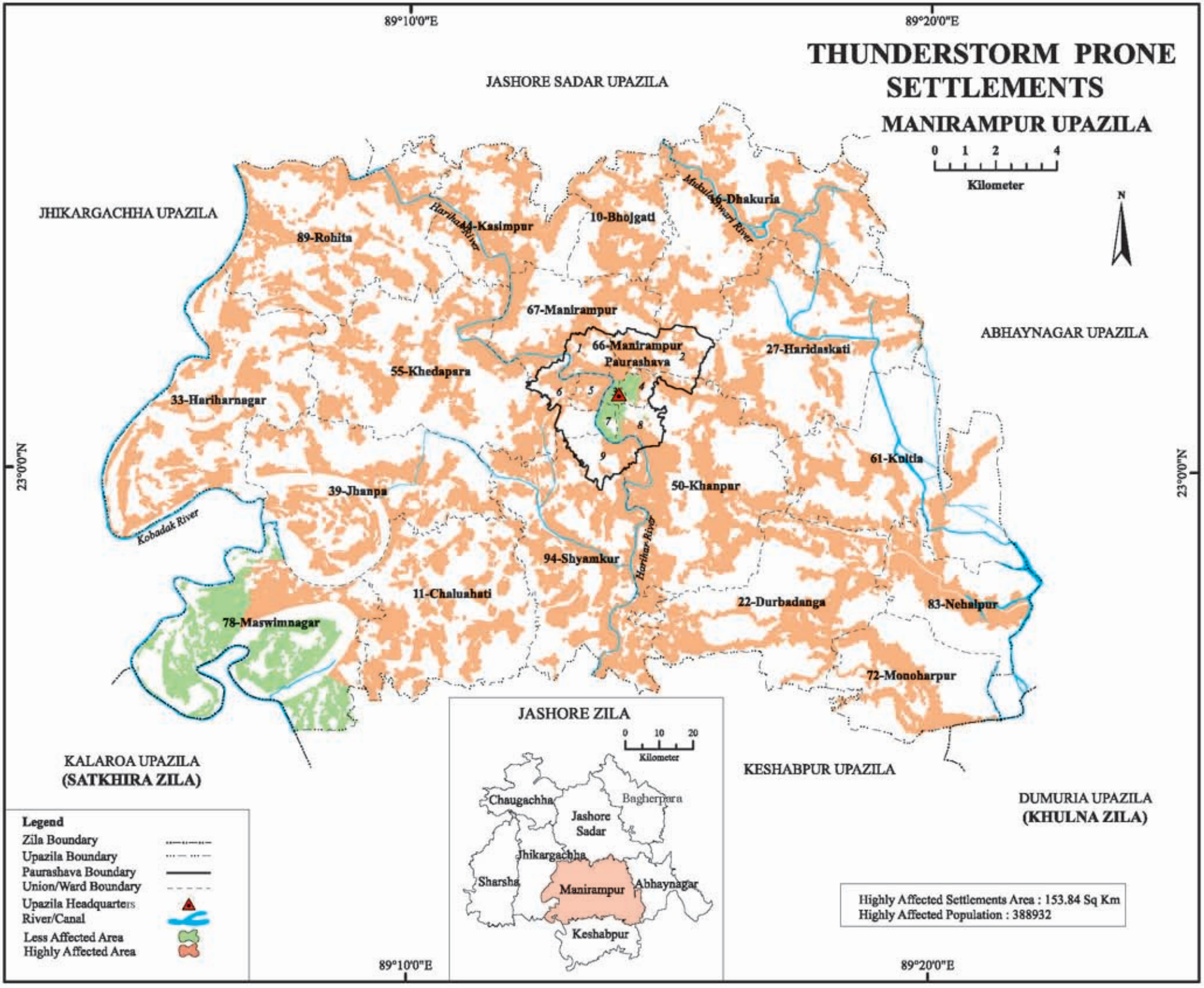
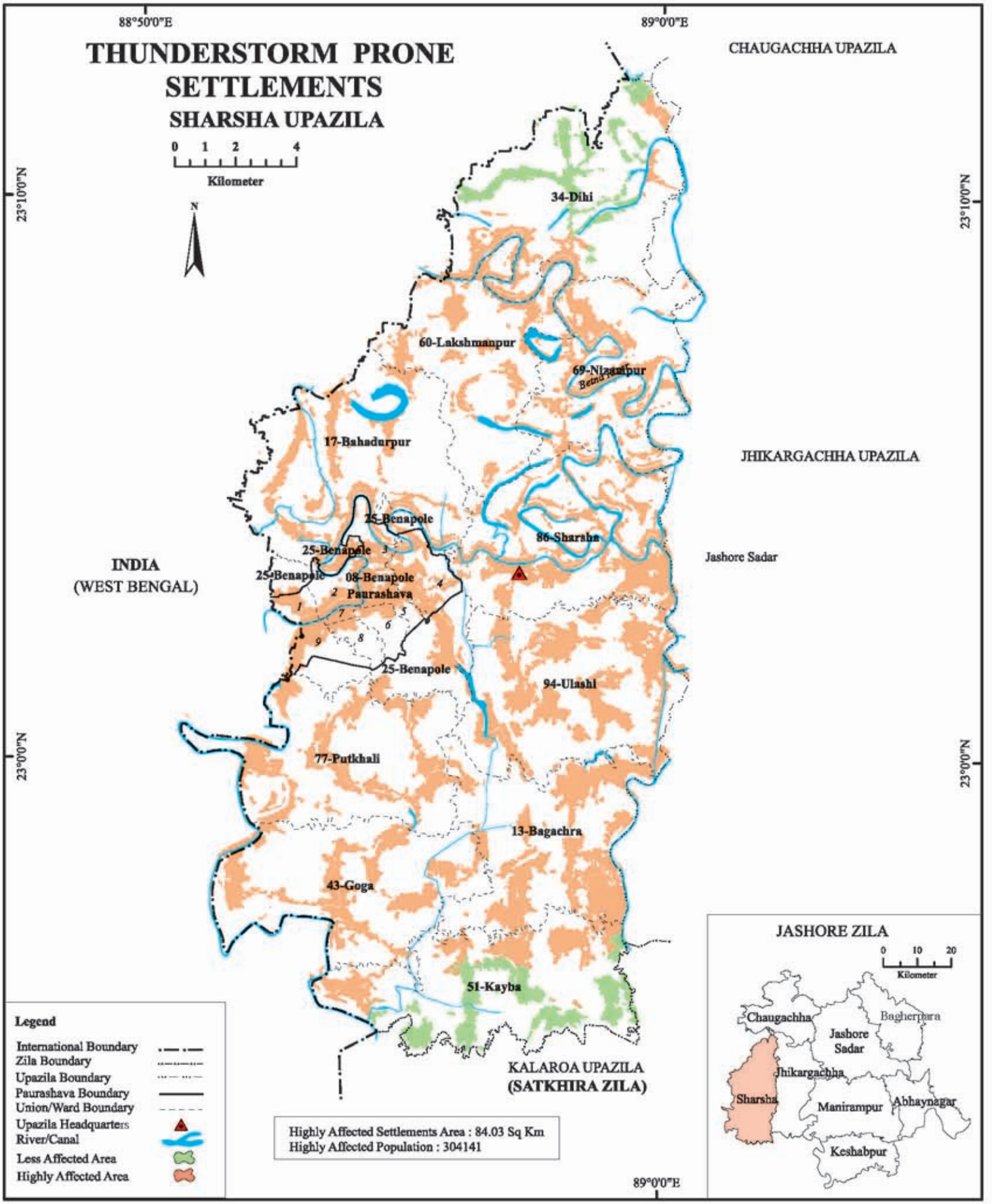
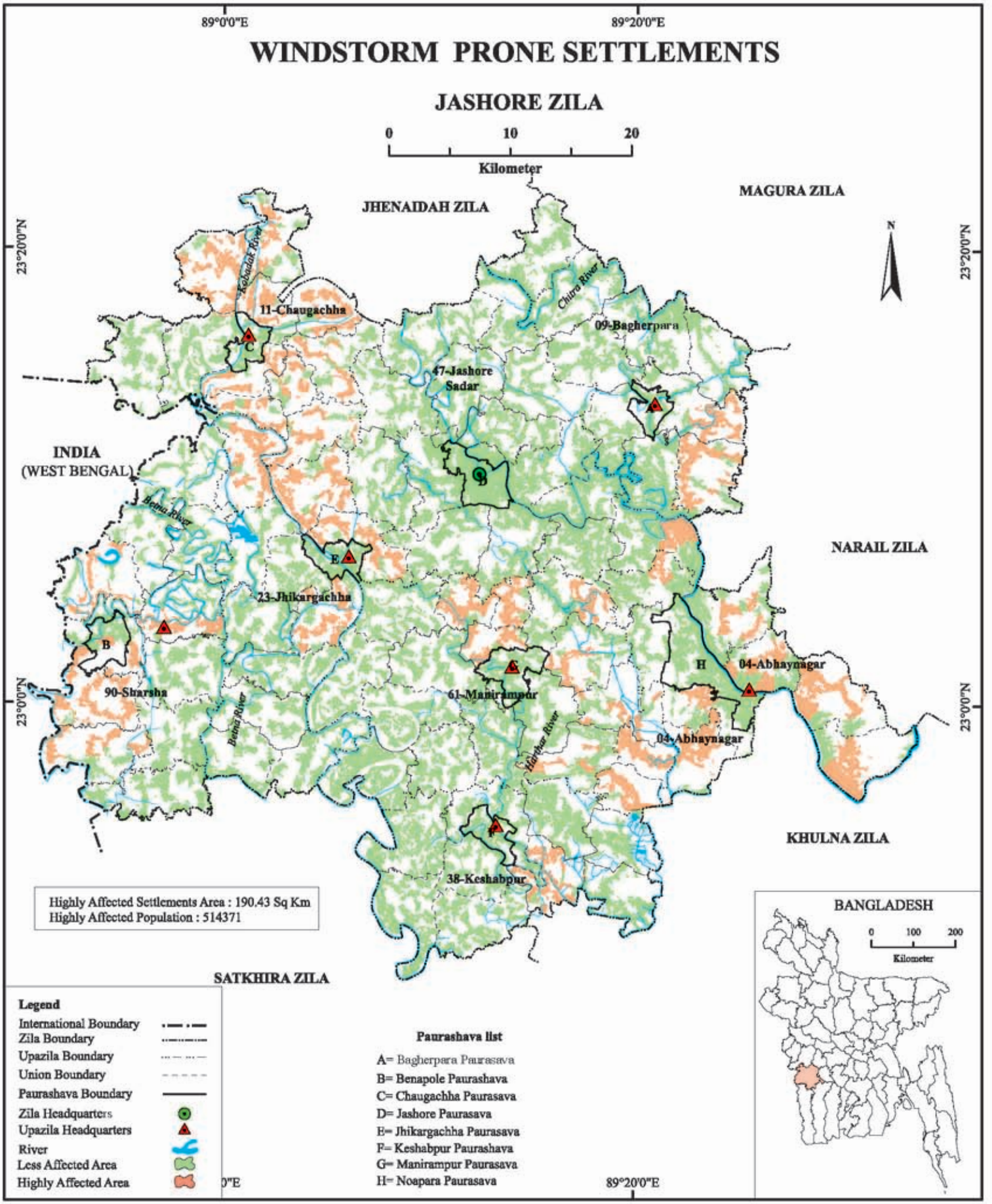


Source: Field Servey, Stat4Dev Project, BBS, 2021



Source: Field Servey, Stat4Dev Project, BBS, 2021

Windstorm Prone Area Map



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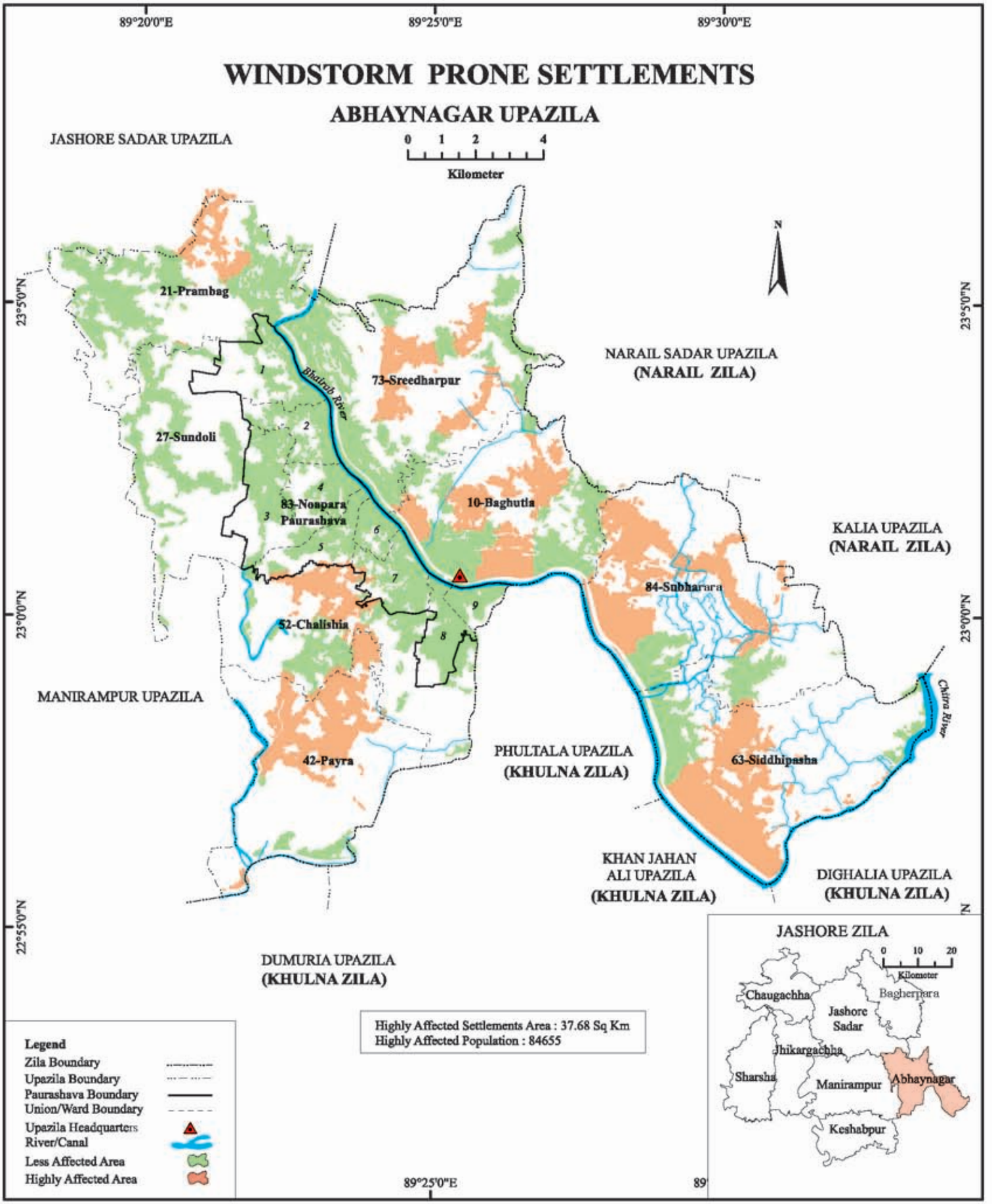

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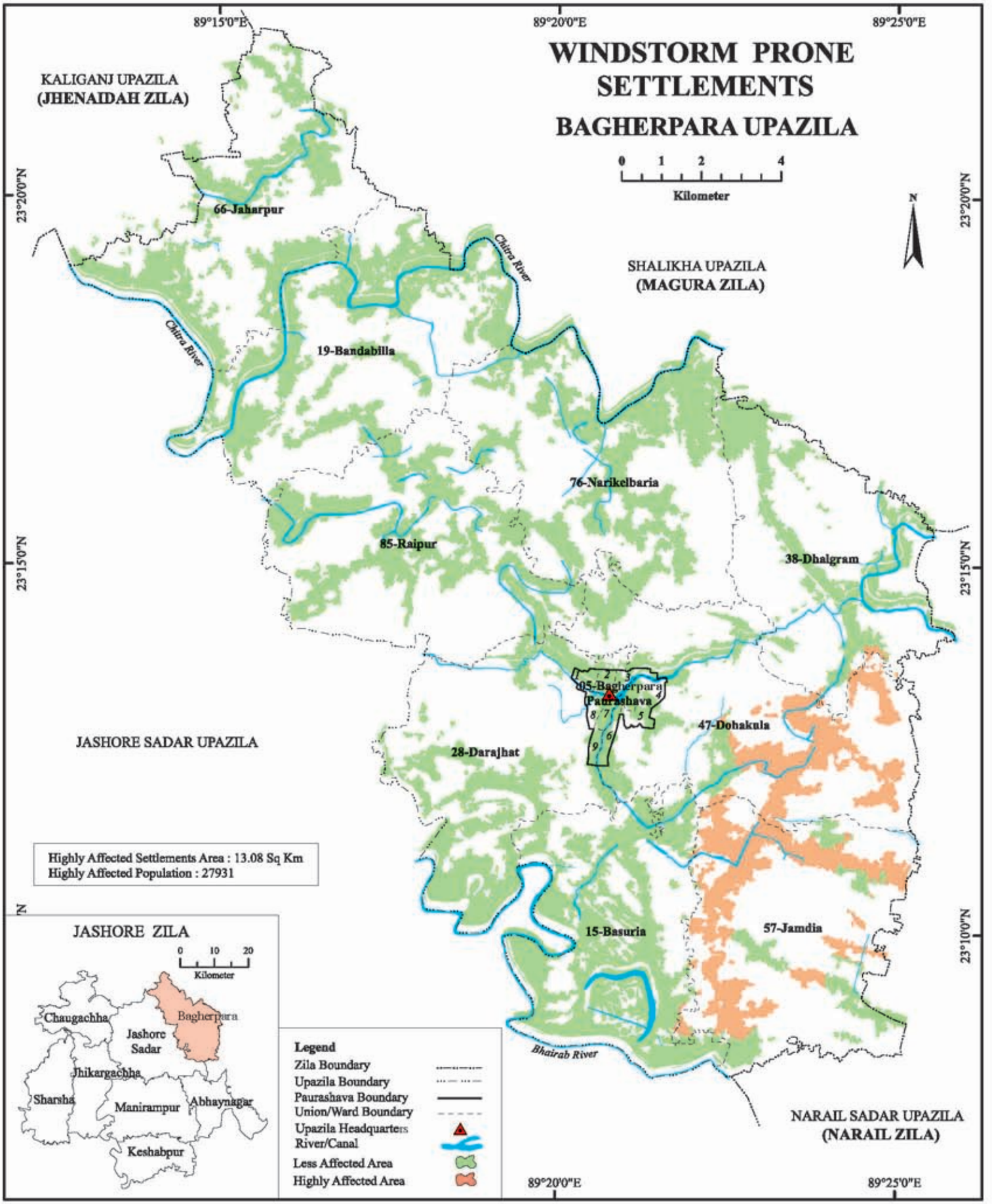

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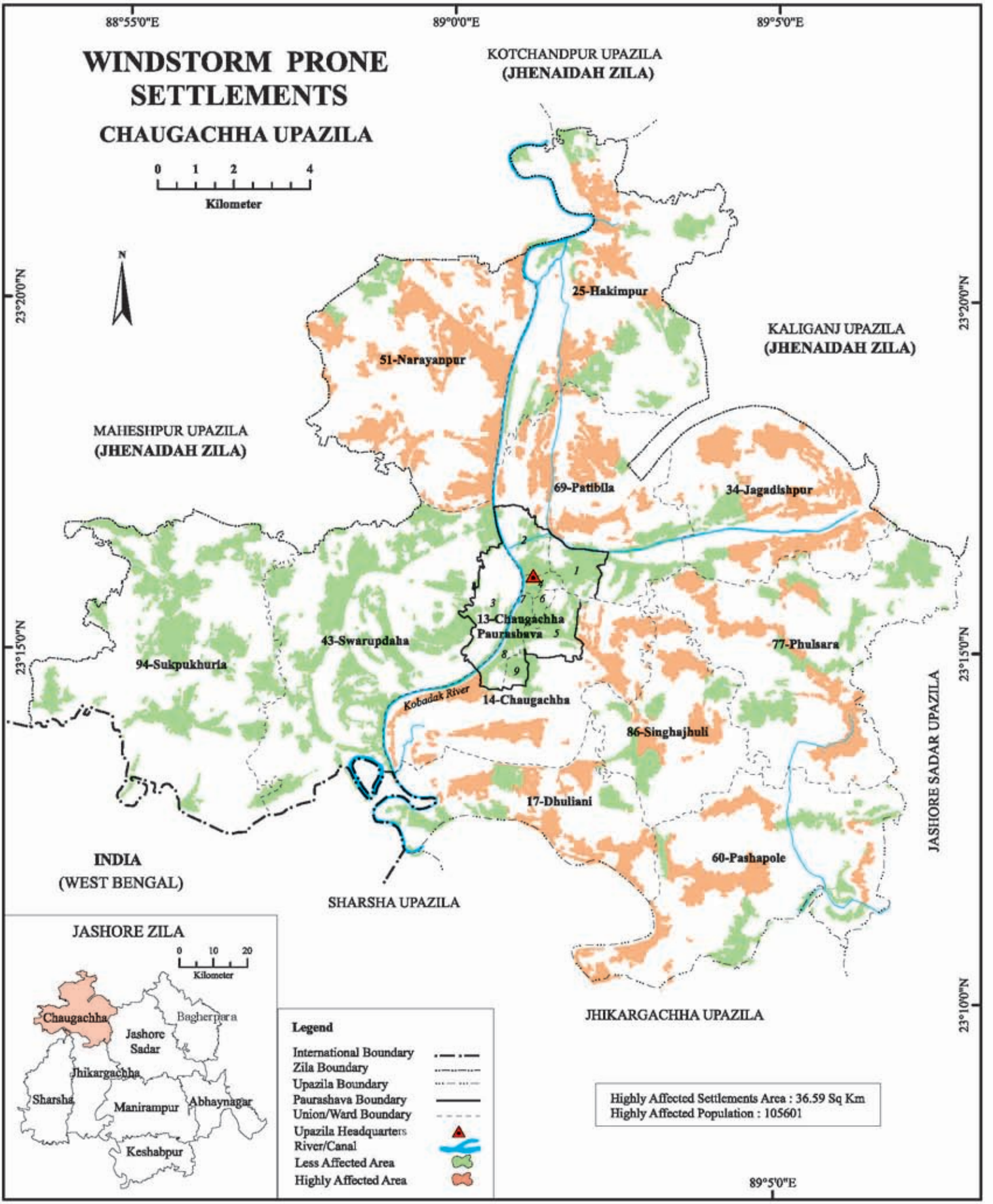

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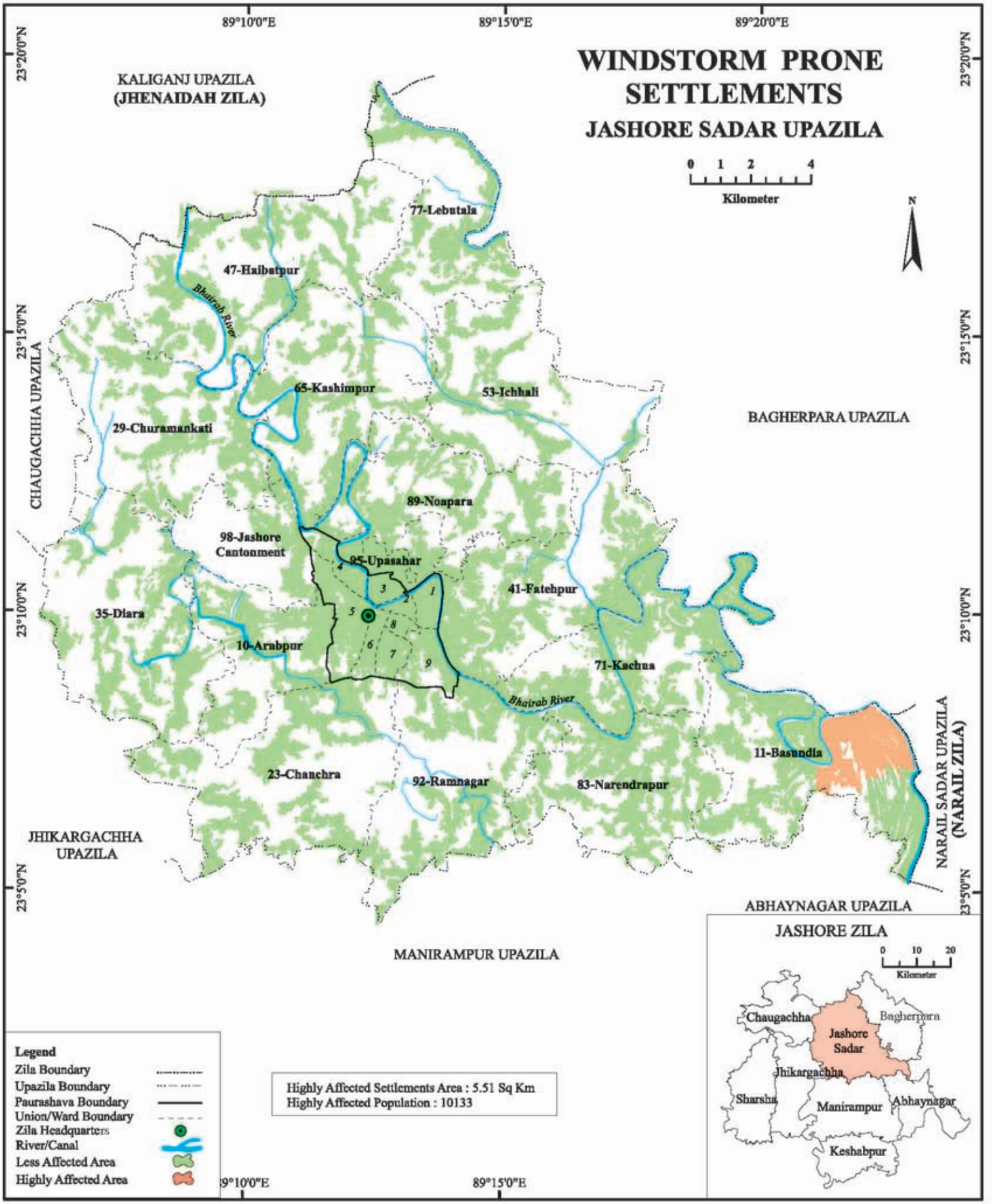

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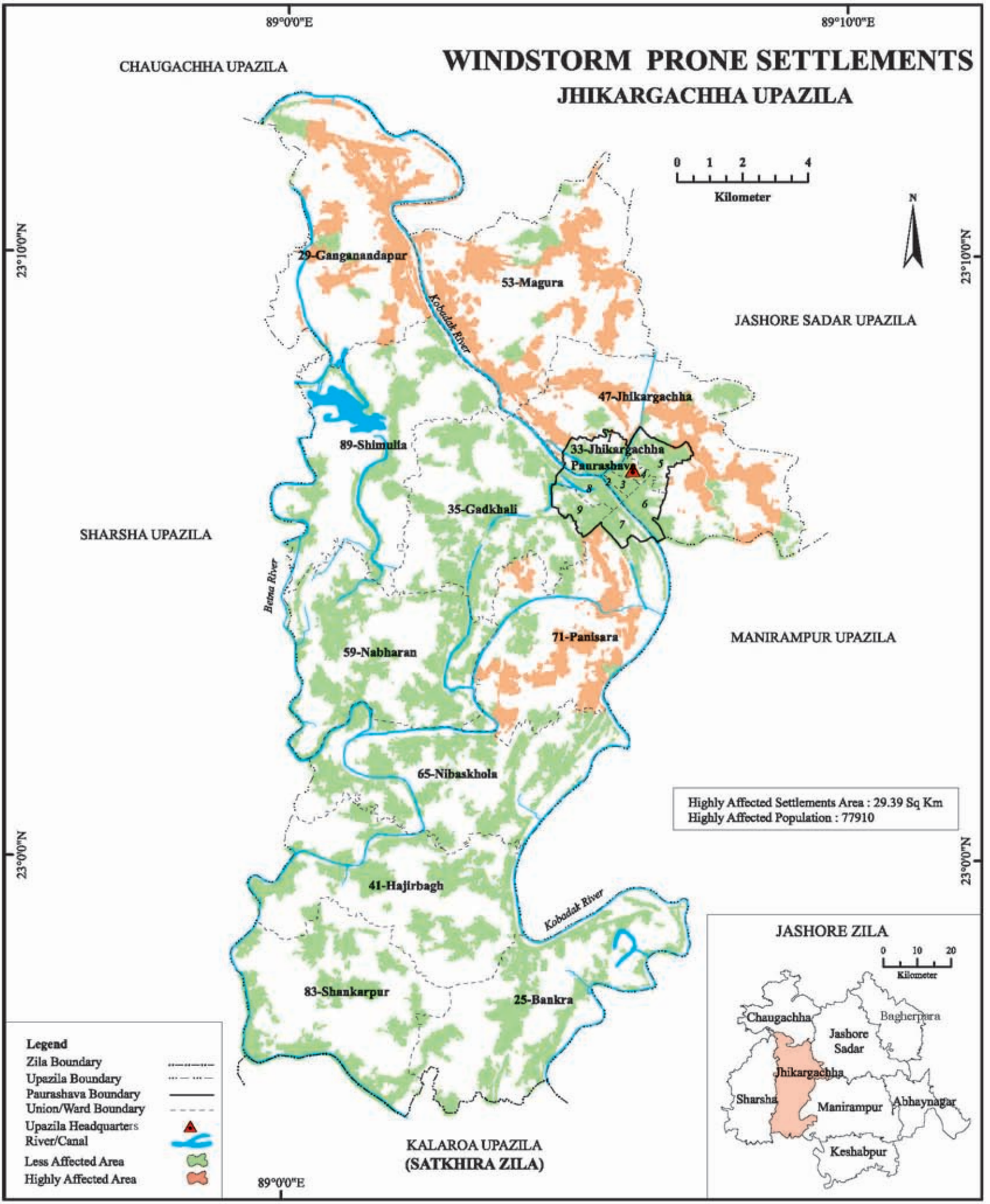
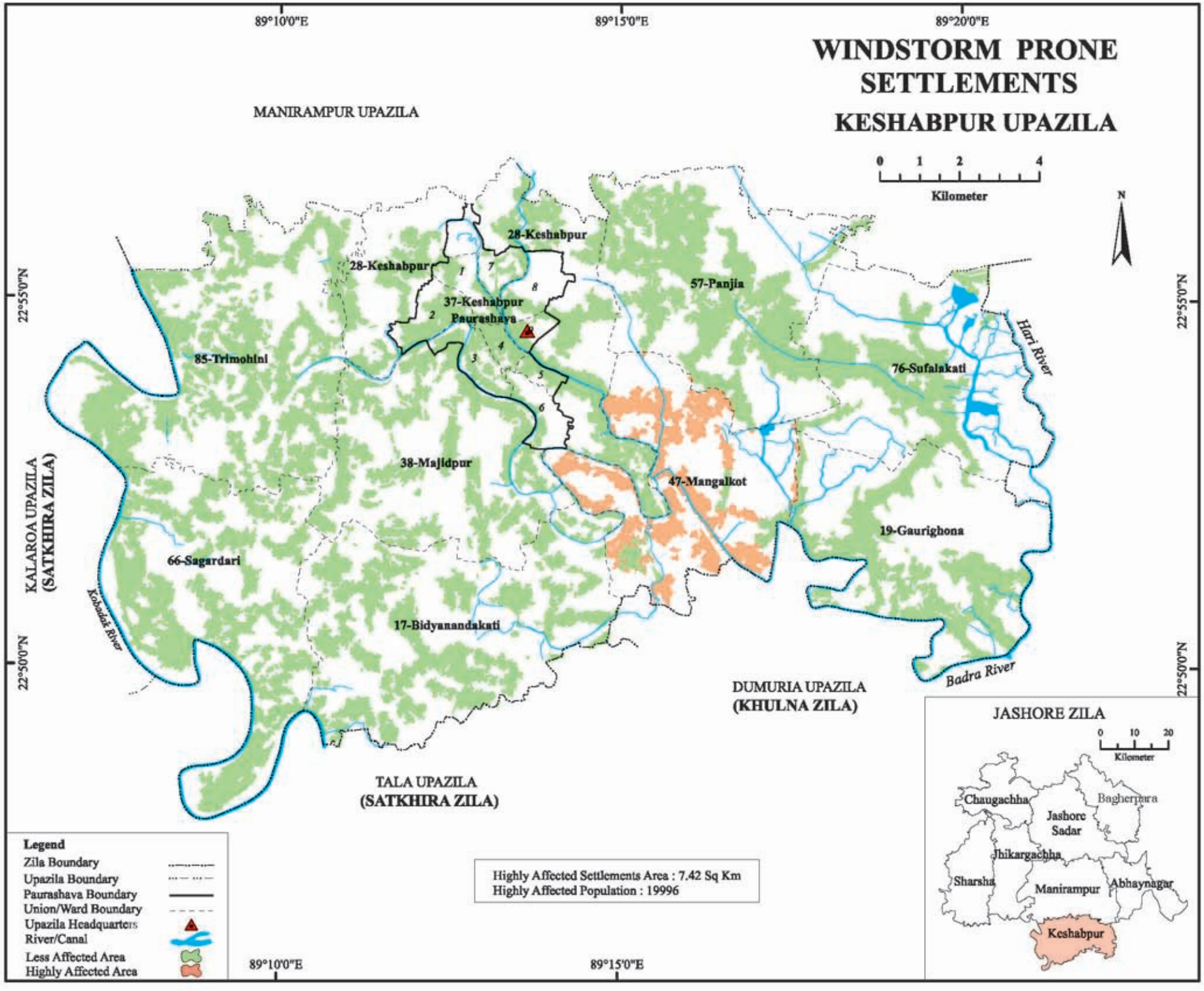
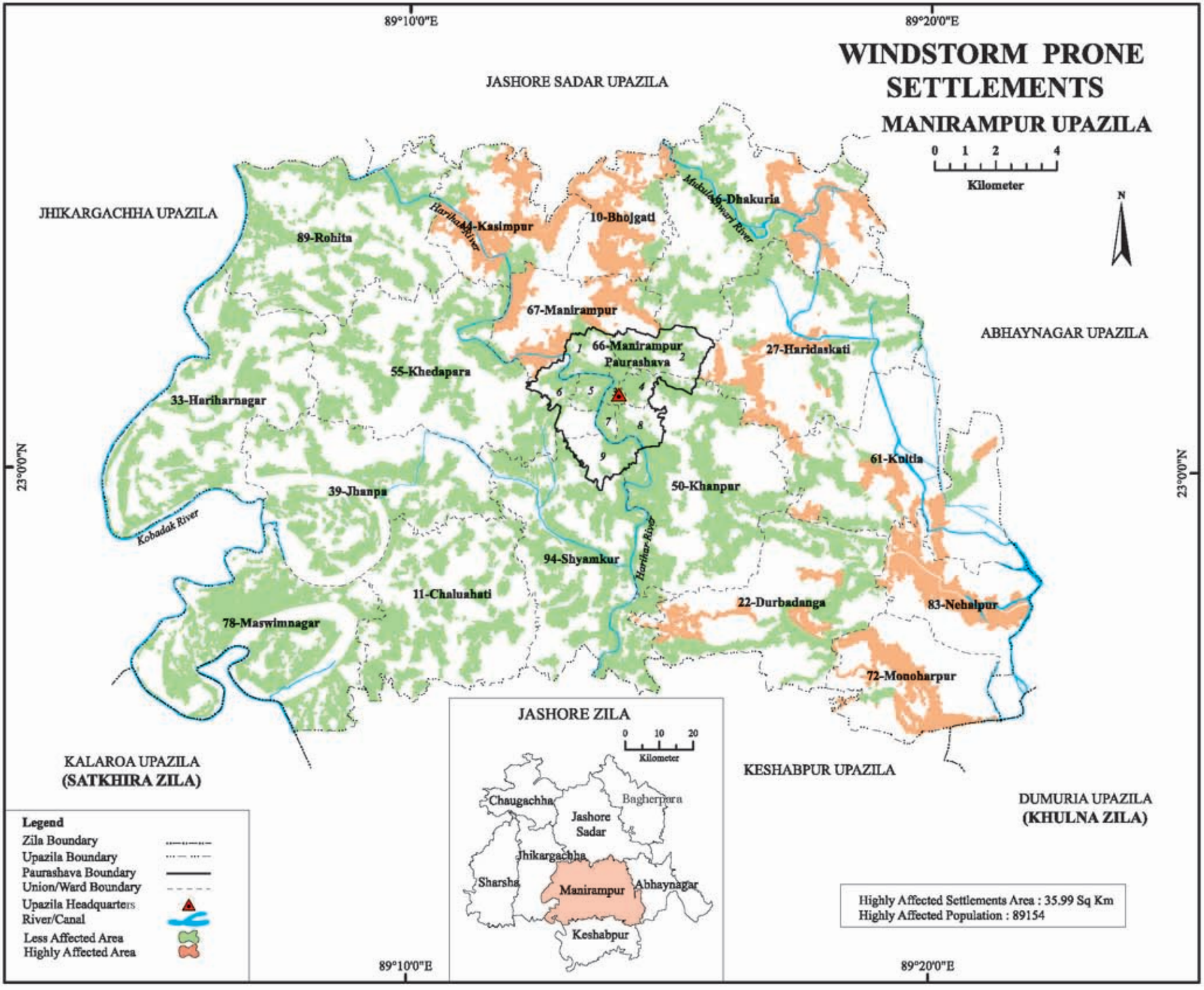
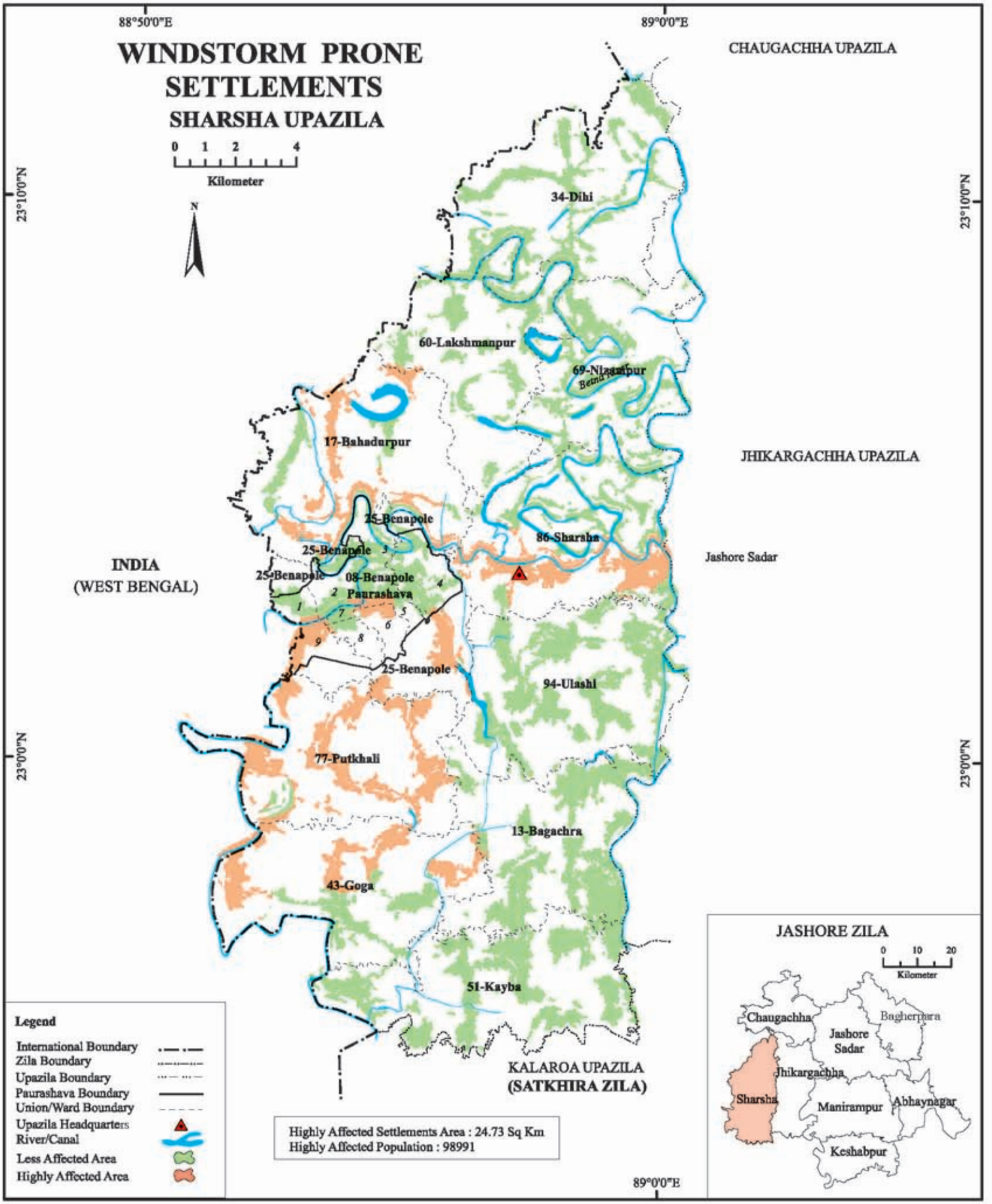


Source: Field Servey, Stat4Dev Project, BBS, 2021



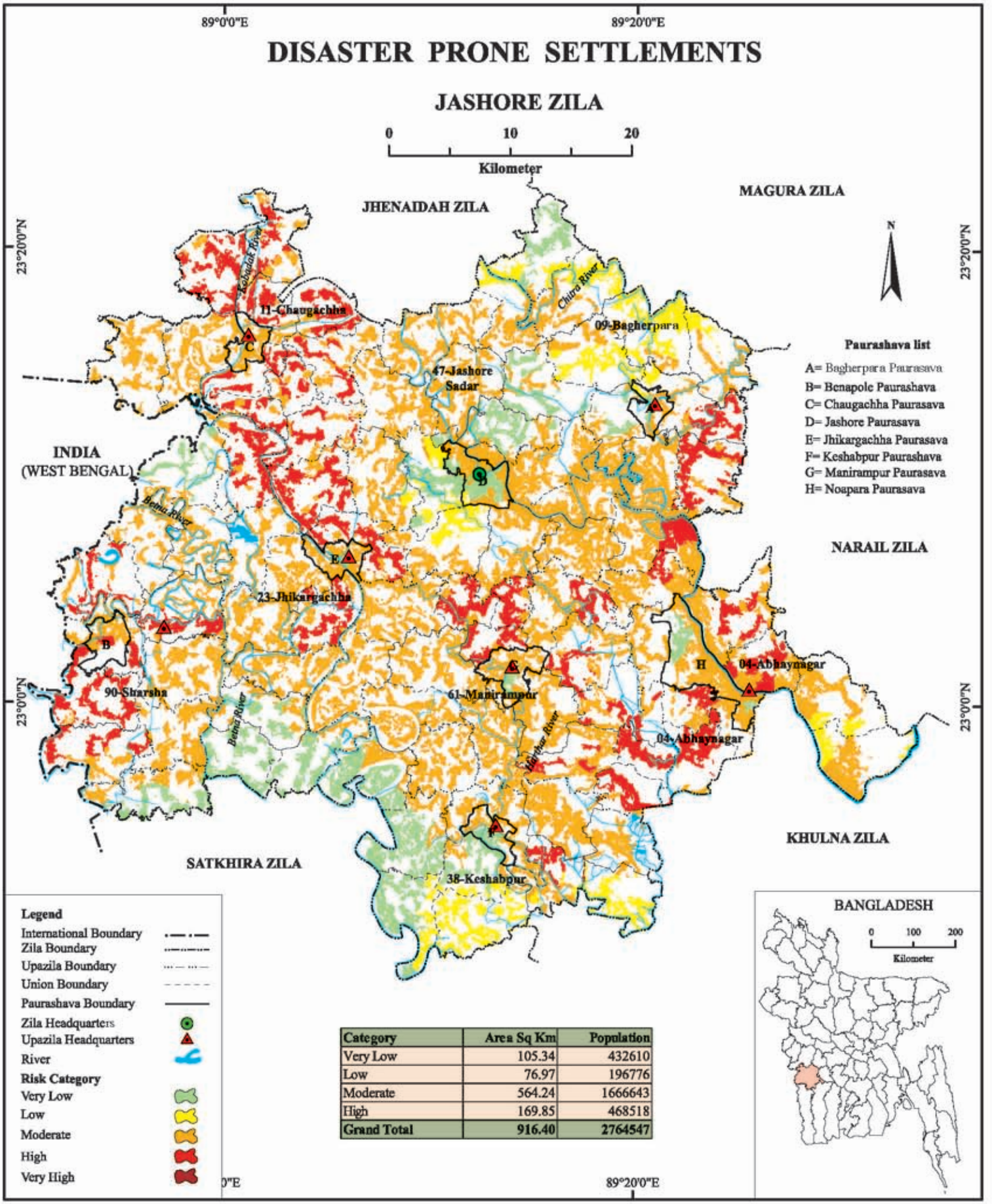
Source: Field Survey, Stat4Dev Project, BBS, 2021


WINDSTORM PRONE SETTLEMENTS
MANIRAMPUR UPAZILA
Source: Field Servey, Stat4Dev Project, BBS, 2021
89°10'0"E
89°20'0"E
23°0'0"N
JASHORE SADAR UPAZILA
JHIKARGACHHA UPAZILA
ABHAYNAGAR UPAZILA
KALAROA UPAZILA
(SATKHIRA ZILA)
KESHABPUR UPAZILA
DUMURIA UPAZILA
(KHULNA ZILA)
0 1 2 4
Kilometer
N
Harihar River
Mukteshwari River
Kobadak River
4-Kasimpur
10-Bhojgati
9-Dhakuria
89-Rohita
67-Manirampur
66-Manirampur Paurashava
27-Haridaskati
55-Khedapara
33-Hariharnagar
61-Kultia
50-Khanpur
39-Jhanpa
94-Shyamkur
11-Chaluahati
22-Durbadanga
83-Nehalpur
78-Maswimnagar
72-Monoharpur
1
2
3
4
5
6
7
8
9
JASHORE ZILA
0 10 20
Kilometer
Chaugachha
Bagherpara
Jashore Sadar
Jhikargachha
Sharsha
Manirampur
Abhaynagar
Keshabpur
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union/Ward Boundary
Upazila Headquarters
River/Canal
Less Affected Area
Highly Affected Area
Highly Affected Settlements Area : 35.99 Sq Km
Highly Affected Population : 89154



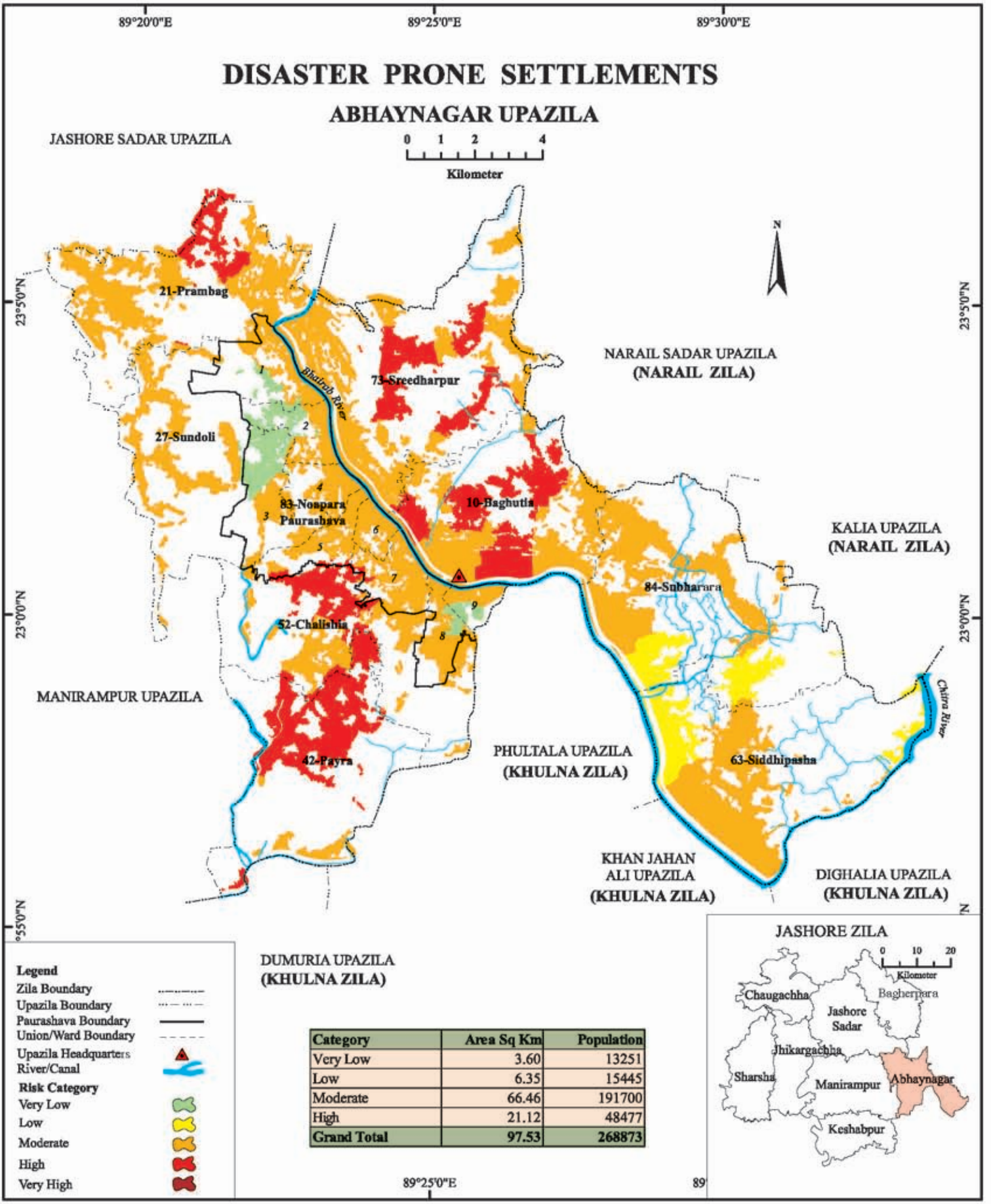
Source: Field Servey, Stat4Dev Project, BBS, 2021

Disaster Prone Settlements



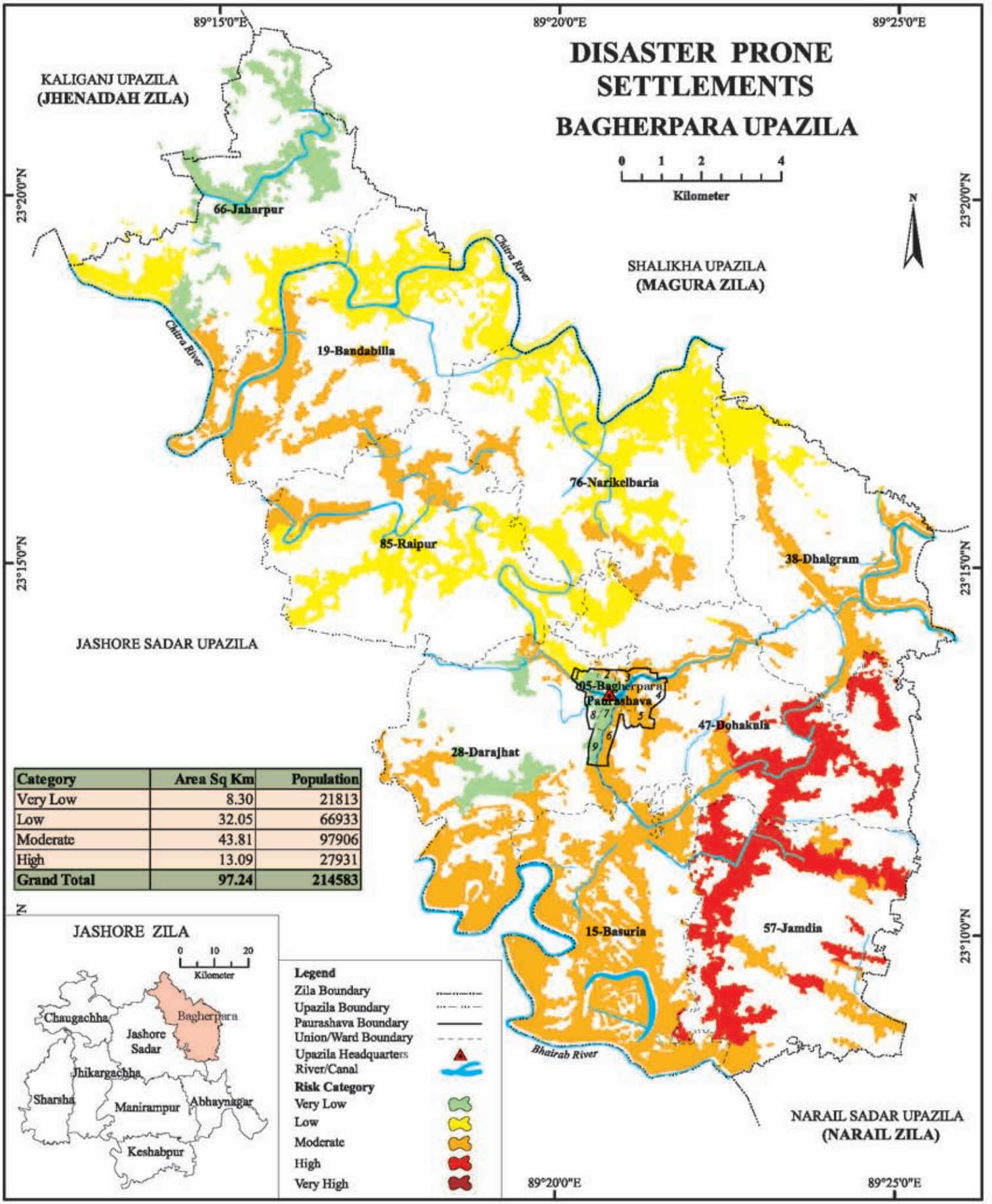
Category	Area Sq Km	Population
Very Low	105.34	432610
Low	76.97	196776
Moderate	564.24	1666643
High	169.85	468518
Grand Total	**916.40**	**2764547**

Source: Field Servey, Stat4Dev Project, BBS, 2021



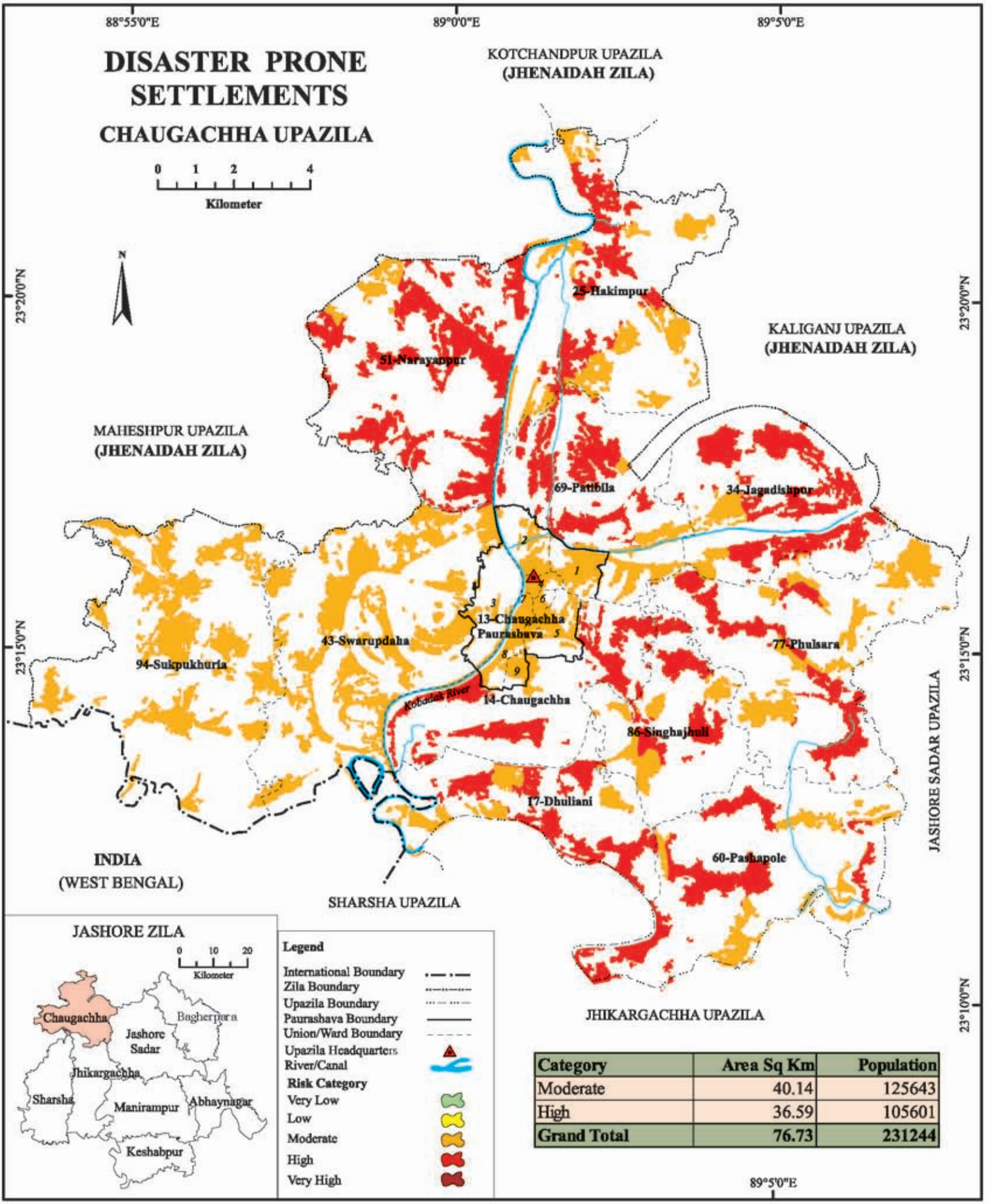
Category	Area Sq Km	Population
Very Low	3.60	13251
Low	6.35	15445
Moderate	66.46	191700
High	21.12	48477
Grand Total	**97.53**	**268873**

Source: Field Servey, Stat4Dev Project, BBS, 2021



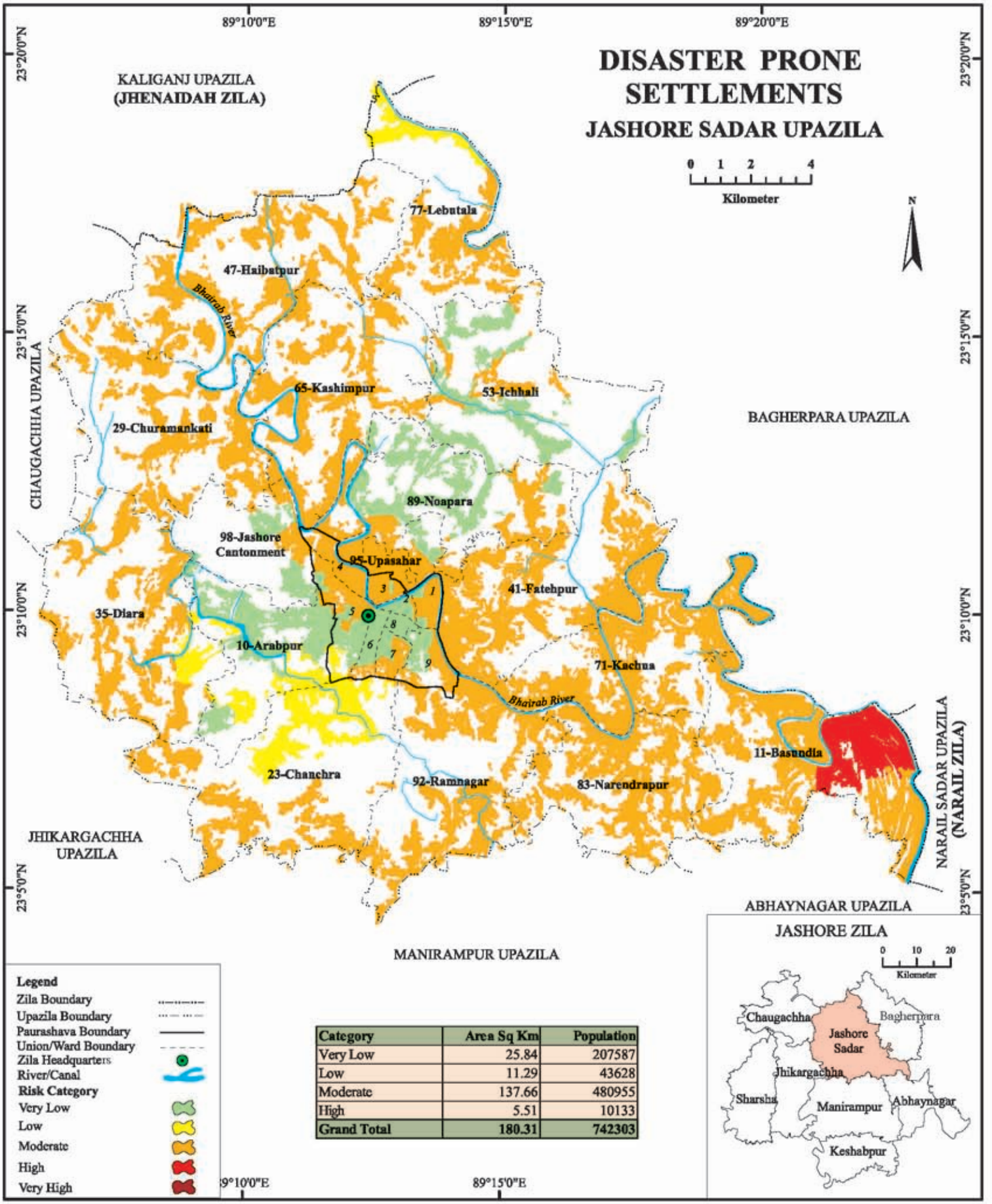
Category	Area Sq Km	Population
Very Low	8.30	21813
Low	32.05	66933
Moderate	43.81	97906
High	13.09	27931
Grand Total	**97.24**	**214583**

Source: Field Servey, Stat4Dev Project, BBS, 2021



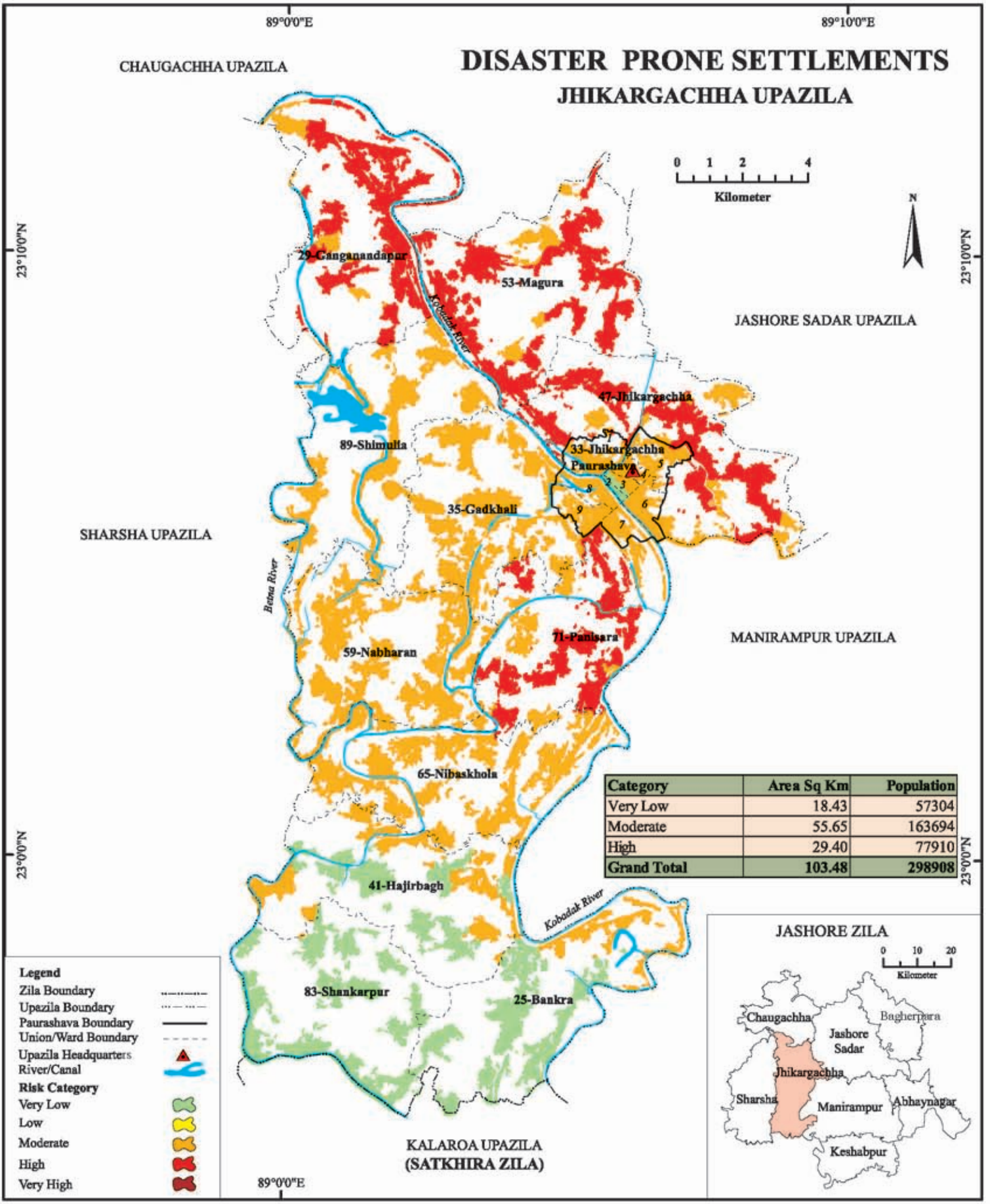
Category	Area Sq Km	Population
Moderate	40.14	125643
High	36.59	105601
Grand Total	**76.73**	**231244**

Source: Field Servey, Stat4Dev Project, BBS, 2021



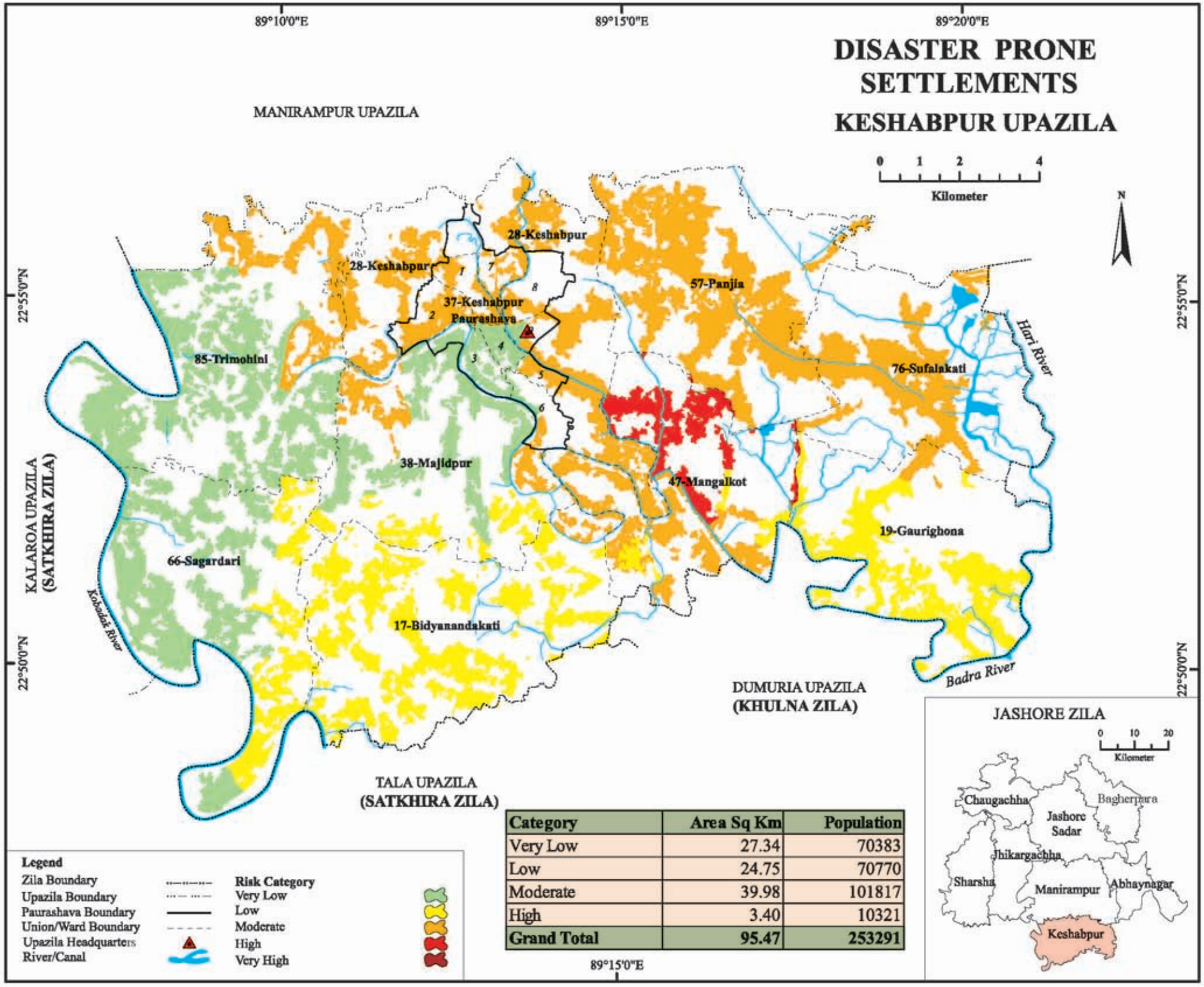
Category	Area Sq Km	Population
Very Low	25.84	207587
Low	11.29	43628
Moderate	137.66	480955
High	5.51	10133
Grand Total	**180.31**	**742303**

Source: Field Servey, Stat4Dev Project, BBS, 2021



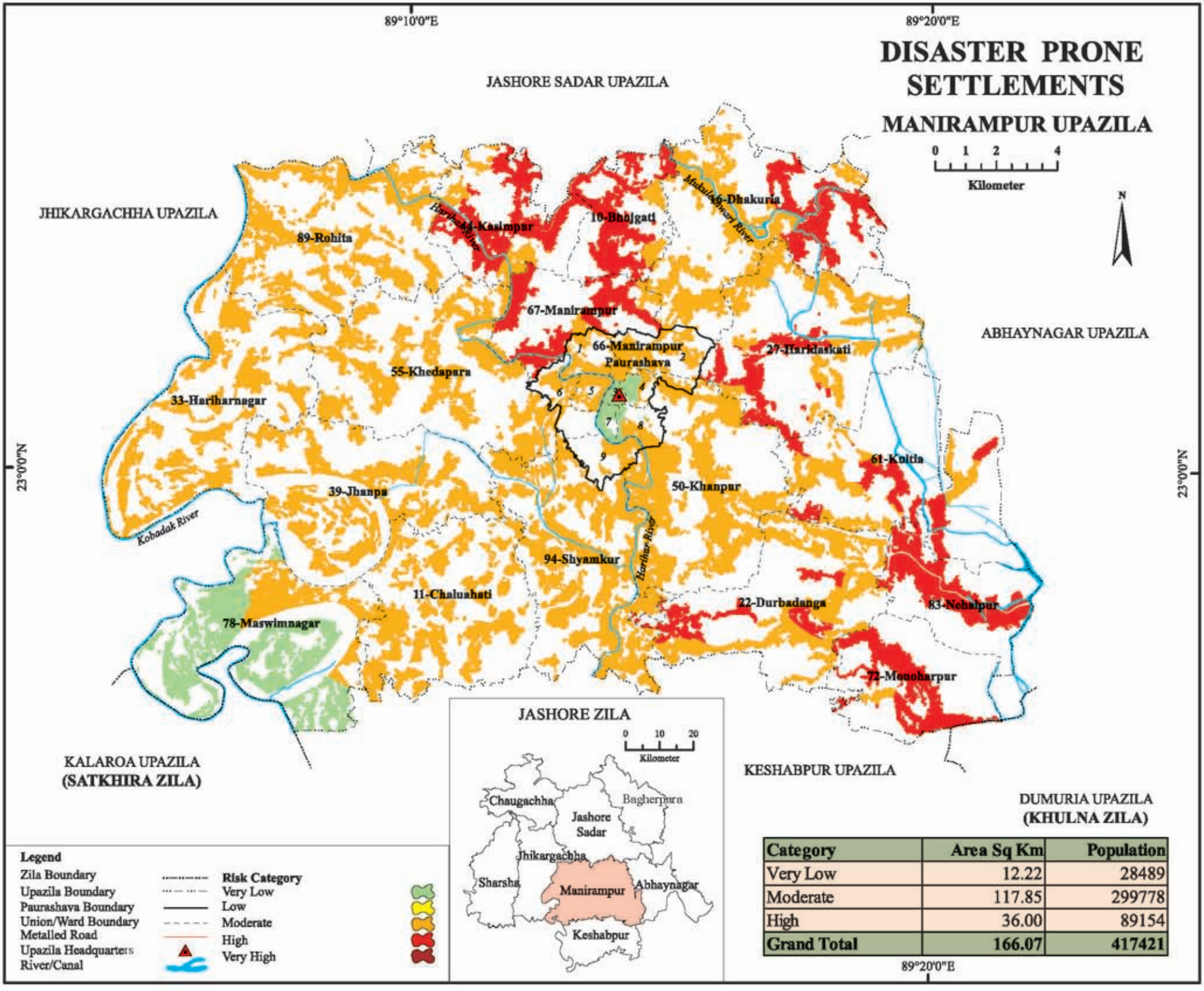
Category	Area Sq Km	Population
Very Low	18.43	57304
Moderate	55.65	163694
High	29.40	77910
Grand Total	**103.48**	**298908**

Source: Field Servey, Stat4Dev Project, BBS, 2021



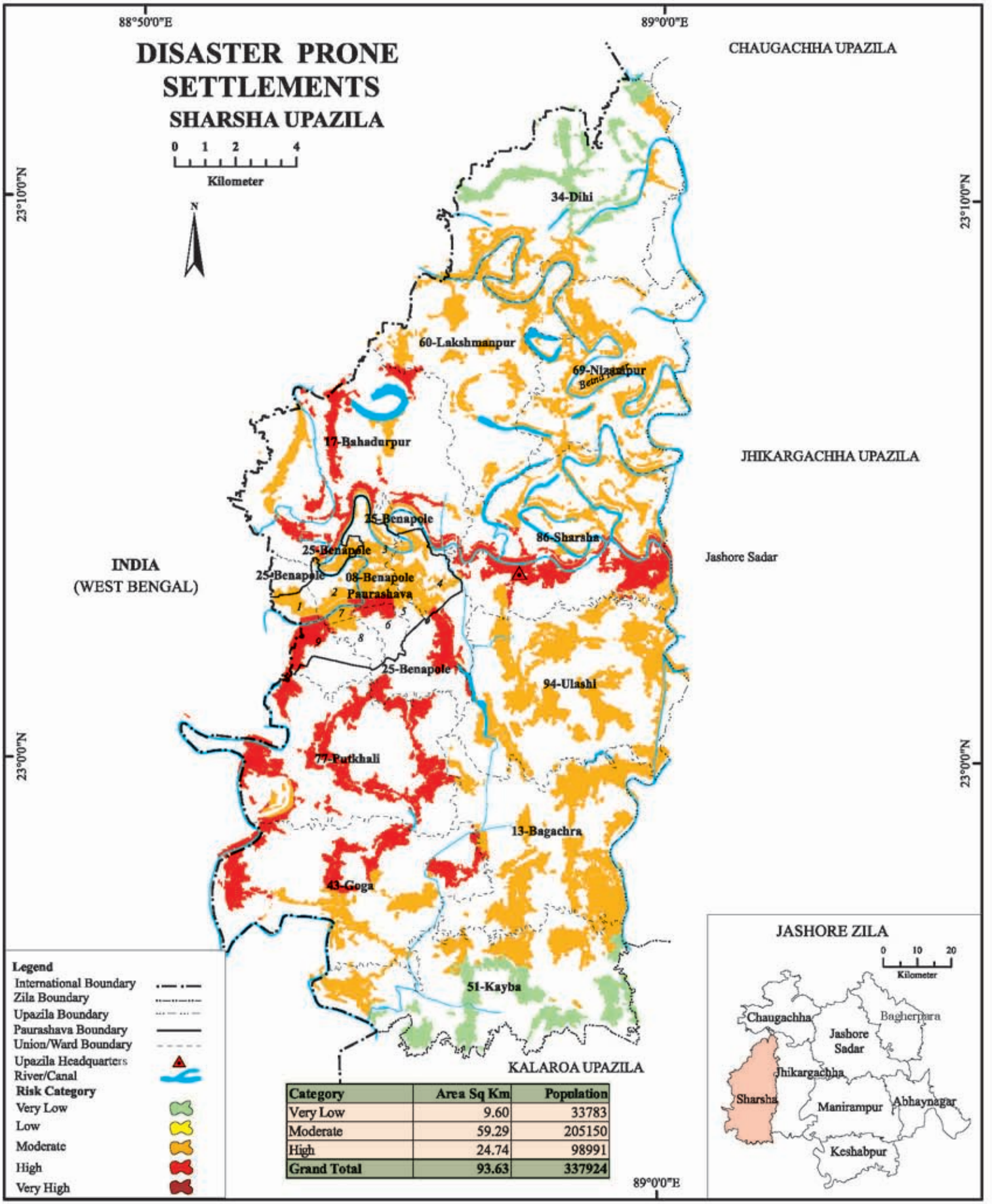
Category	Area Sq Km	Population
Very Low	27.34	70383
Low	24.75	70770
Moderate	39.98	101817
High	3.40	10321
Grand Total	**95.47**	**253291**

Source: Field Survey, StatDev Project, BBS, 2021



Category	Area Sq Km	Population
Very Low	12.22	28489
Moderate	117.85	299778
High	36.00	89154
Grand Total	**166.07**	**417421**

Source: Field Servey, Stat4Dev Project, BBS, 2021



Category	Area Sq Km	Population
Very Low	9.60	33783
Moderate	59.29	205150
High	24.74	98991
Grand Total	**93.63**	**337924**

Source: Field Servey, Stat4Dev Project, BBS, 2021

Appendix A

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁও, ঢাকা ১২০৭

দুর্যোগ প্রবণ এলাকা অ্যাটলাস (Disaster Prone Area Atlas) তৈরির জন্য তথ্য সংগ্রহ ফরম

জেলার নাম: কোড:	সিটি কর্পোরেশনের নাম: কোড:	উপজেলার নাম: কোড:	পৌরসভার নাম: কোড:
ইউনিয়নের নাম: কোড:	ওয়ার্ডের নাম: কোড:	গ্রামের নাম: কোড:	মহল্লার নাম: কোড:

১. অবকাঠামো / স্থাপনার নাম:			
২. অবকাঠামো / স্থাপনার অবস্থান:	অক্ষাংশ **(Y):**	দ্রাঘিমাংশ **(X):**	
৩. স্থাপনার প্রতিষ্ঠাকাল:		৪.স্থাপনাটি কত তলাবিশিষ্ট:	তলা
৫. স্থাপনার ধরন (অবকাঠামো):	**(নিচের নোট অনুযায়ী লিখুন)	পাকা 1	আধা পাকা 2
৬. মোট কামরার সংখ্যা:		৭. মোট আয়তন (বর্গফুট):	বর্গফুট
৮. জেলার সঙ্গে যোগাযোগের মাধ্যম: ৯. উপজেলার সঙ্গে যোগাযোগের মাধ্যম:	ক. সড়কপথ: কাঁচা / পাকা ..... কি.মি. ক. সড়কপথ: কাঁচা / পাকা ..... কি.মি.	খ. জলপথ: ..... কি.মি. খ. জলপথ: .....কি.মি.	গ. রেলপথ: ..... কি.মি. গ. রেলপথ: ..... কি.মি.
১০. খোলা মাঠ আছে কি?	হ্যাঁ 1	না 2	হ্যাঁ হলে, আয়তন (বর্গফুট): বর্গফুট
১১.বিদ্যুৎ সুবিধা আছে কি?	হ্যাঁ 1	না 2	১২. টেলিভিশন আছে কি? হ্যাঁ 1 না 2
১৩. সংঘটিত দুর্যোগের বিবরণ:			

দুর্যোগ প্রবণ এলাকা অ্যাটলাস (Disaster Prone Area Atlas) তৈরির জন্য তথ্য সংগ্রহ ফরম

দুর্যোগের ধরন (কোডসহ)	কারণ (কোডসহ)	সময় (কোডসহ) (কোন মাসে)	উৎস (কোডসহ) (প্রাকৃতিক/ মানবসৃষ্ট)	স্থায়িত্ব (দিন/মাস)	ব্যাপ্তি (মৌজা /গ্রামের নাম)	কত দিন পর পর সংঘটিত হয়	গত ৫ বছরে কতবার সংঘটিত হয়েছে

**** যে সমস্ত তথ্য সংগ্রহ করতে হবে:** 1. শিক্ষাপ্রতিষ্ঠান (প্রাথমিক /নিম্নমাধ্যমিক/উচ্চমাধ্যমিক বিদ্যালয়, মাদ্রাসা, কলেজ/বিশ্ববিদ্যালয়) 2. সাইক্লোন শেল্টার 3. হাসপাতাল/ক্লিনিক 4.ব্যক্তি মালিকানাধীন বহুতল ভবন 5. বাস/রেলস্টেশন 6. হেলিপ্যাড 7. স্টিমার/লঞ্চঘাট 8. বিমানবন্দর

দুর্যোগকালে লোকজনদের আশ্রয়স্থল, অসুস্থ লোকজনদের জরুরি চিকিৎসার জন্য ফিল্ড হাসপাতাল স্থাপনের জায়গা, জরুরি ত্রাণ সহায়তা প্রদান ইত্যাদির জন্য অবকাঠামোর নাম, দুর্যোগকালীন সহায়তা, উদ্ধার ইত্যাদির জন্য যোগাযোগ ব্যবস্থার পূর্ণাঙ্গ বর্ণনা ম্যাপে প্রদর্শন এবং প্রদত্ত ফরমে সঠিক তথ্য সংগ্রহ করা আবশ্যক। জিপিএস রিডিংয়ের জন্য স্থাপনার নিকট গিয়ে রিডিং নিতে হবে।

তথ্য প্রদানকারীর নাম: পিতার নাম: মাতার নাম: বয়স: পেশা: মোবাইল নম্বর:	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁও, ঢাকা ১২০৭

Paurashava/Union Wise Disaster Calendar for Coastal Area of Bangladesh

জেলার নাম: কোড:	সিটি কর্পো: নাম: কোড:	উপজেলার নাম: কোড:	পৌরসভার নাম: কোড:	ইউনিয়নের নাম: কোড:	ওয়ার্ডের নাম: কোড:

DISASTER	Jan পৌষ/মাঘ	Feb মাঘ/ফাল্গুন	Mar ফাল্গুন/চৈত্র	Apr চৈত্র/বৈশাখ	May বৈশাখ/জ্যৈষ্ঠ	Jun জ্যৈষ্ঠ/আষাঢ়	Jul আষাঢ়/শ্রাবণ	Aug শ্রাবণ/ভাদ্র	Sep ভাদ্র/আশ্বিন	Oct আশ্বিন/কার্তিক	Nov কার্তিক/অগ্রহায়ণ	Dec অগ্রহায়ণ/পৌষ	RANK

তথ্য প্রদানকারীর নাম: পিতার নাম: মাতার নাম: বয়স: পেশা: মোবাইল নম্বর:	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

Statistics for DEVELOPMENT

Strengthening Statistical Capacity of BBS for Collecting Data on Population and Development Project

Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning

Parisankhyan Bhaban (Level-9, Block-B)
E-27/A, Agargaon, Dhaka-1207
Phone : 880-2-9110823
www.bbs.gov.bd, www.sid.gov.bd