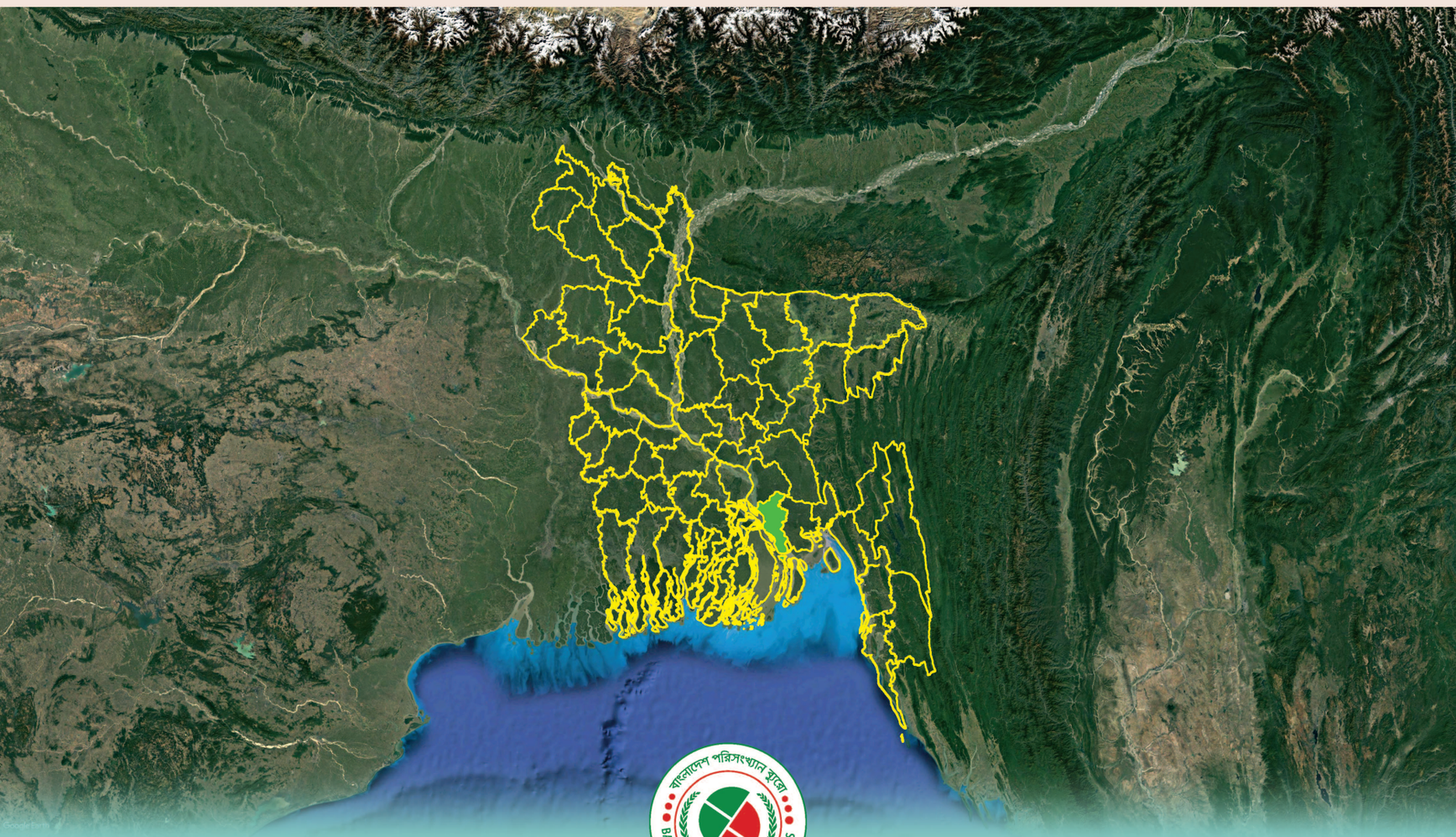
2051

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

DISASTER PRONE AREA ATLAS BANGLADESH

LAKSHMIPUR ZILA



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

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Map of Bangladesh highlighting the concern Zila

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Complimentary

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June, 2020

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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

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Foreword

Bangladesh Bureau of Statistics (BBS), the National Statistical Organization (NSO), is responsible for collecting, compiling and disseminating of 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 conduct lots of Inter-censual survey and generate lots of analytical reports for the users which are mainly used for planning and policymaking 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, academic and technical institutions, the private sector and development partners. The role of Government is mainly to ensure that risk reduction and comprehensive disaster management programmes are in place. Given 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 to visualize the vulnerability through map and statistics. The disaster prone atlas of Lakshmipur District is one of the output of such initiative.

Let me take privilege to thank UNFPA for providing financial and technical support to Stat4Dev Project of BBS under which this Atlas is prepared. I would like to thank the working group comprising relevant experts from 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, GIS 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 of the Atlas.

Dhaka: June, 2020

Saurendra Nath Chakrabhartty

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) already has been entered into a new 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 also empowered BBS to provide guidance to other agencies for producing official Statistics and authenticate statistics generated by them. The Act also given responsibility to BBS to prepare Integrated Geographical Information System (GIS) to foster integration of GIS with Statistics. According to 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 that mandate, previously BBS Published small area atlas for 64 districts. Now BBS is going to prepare the disaster prone area atlas for 15 coastal districts of the country for the first time. The disaster prone area atlas of Bangladesh is a tool to enhance decision-making to reduce 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 Lakshmipur District is one of the outcome 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 to Mr. Md. Zahidul Hoque Sardar, Project Director; Md. Maksud Hossain, Deputy Director 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: June, 2020

Mohammad Tajul Islam

Representative
UNFPA Bangladesh

Message

I am glad to know the Bangladesh Bureau of Statistics (BBS), under the Statistics and Informatics Division (SID) of the Ministry of Planning of the Government of Bangladesh, has taken the initiative of publishing the Disaster-Prone Area ATLAS prepared by the UNFPA-supported project with BBS. An ATLAS is a handy tool to identify and reveal the exact location and geophysical and socio-economic characteristics of a geographical area. I believe this Disaster-Prone ATLAS will give a clear understanding of spatial and temporal occurrences of natural calamities and will be beneficial in mitigation strategies and preparedness plans, allocation of resources for a response, and will provide the decision support system in disaster management.

UNFPA assists the national efforts at building and sustaining capacities for knowledge management and data/ statistics systems, for integrating population dynamics into national planning and monitoring systems. It commits UNFPA Bangladesh to strengthen national capacity for the production and use of age, sex and location disaggregated population data, in line with the Sustainable Development Goals (SDGs) and International Conference on Population and Development (ICPD) beyond 2014. The 2030 Agenda for Sustainable Development, adopted in 2015, has placed the highest priority on ensuring that “no one is left behind”, calling on national statistical systems to disaggregate national indicators and monitor and redress inequalities as a matter of human rights. This aspiration places a high demand on national data ecosystems, and on data disaggregation by age, sex and location in particular.

Climate change is one of the greatest challenges facing humanity today. Due to its geographical location, geological and climatic conditions, Bangladesh is one of the most disaster-prone countries in the world. UNFPA is working with the Governments and other development partners to understand population dynamics better, how they affect the changing climate and how people can become resilience in the face of these changes. This disaster-prone area ATLAS has visualized through maps and statistics of the existing situation of hazard and the risk of Lakshmipur district.

I would like to express my sincere appreciation to the Director General of BBS, Project Director, and his team for their sincere efforts in successful completion of this tedious job.

Dhaka: June, 2020

Ms. Asa Torkelsson

Project Director
Stat4Dev Project
Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning

Acknowledgement

I am delighted to acknowledge the active role of officials concerned in undertaking the exercise for preparation of 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 Saurendra Nath Chakrabhartty, Secretary, Statistics and Informatics Division (SID), Md. Amir Hossain, Director General, Bangladesh Bureau of Statistics, Ms Mahmuda Akhter, Additional Secretary (Development), Statistics and Informatics Division (SID), for their valuable suggestions, patient guidance, and all-out support for completion of the disaster prone area atlas.

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

Particularly I am grateful to Md. Maksud Hossain, Deputy Director, Md. Firoz Ahmed Sardar, Statistical Officer and other Stat4Dev project's officials 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, who gave his 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 successful completion of the Atlas and data collection from field.

Hope, users and readers will continue to forward their suggestion and comments for further improvement of those documents.

Dhaka: June, 2020

Md. Zahidul Hoque Sardar

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Chapter 1

Introduction

1.1 Background

Bangladesh is broadly distinguished as one of the world's countries most susceptible to climate change and 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) already has 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. According to Statistical Act 2013, BBS has prepared the National Strategy for Development of Statistics (NSDS) aimed 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 visualizing through maps and statistics.

1.3 Scope of the work

Geographically, the survey covered the entire district for the selected 15 coastal districts area. to cover disaster-prone areas (mauzas/mahallas) a mauza/ Mahallah list containing the dominant mauzas/Mahallah across the disaster-prone areas under 17 districts were generated. 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 of 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 and 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 Bangladeshi citizens.

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-government 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. In particular, the UNFPA, aside from providing funding support to the project, have extensively provided technical guidance and assistance to the risk assessment process through its in-house disaster risk assessment expertise.

1.7 Key concepts and definitions

Disaster.

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 are 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, nCovid-19 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 Management Act 2012).

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 subject 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

A dangerous phenomenon, substance, human activity or condition 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. There are hazards of natural origin and related environmental and technical hazards and risks. Such hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological and technical sources, sometimes acting in combination. In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis.

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. (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, unskill and limited to adapt to the effect of natural or human-created hazard or any adverse reaction.

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. Following is the description of some of the natural disasters (with their code number) in Bangladesh.

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 northwestern 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 uses, 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.

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 riverbanks 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.

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 Kapataksma 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 rivulet (i.e., khal) has given rise to temporary waterlogging every year.

Cyclone

A large-scale closed circulation system in the atmosphere with low barometric pressure and strong winds that rotate counterclockwise 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.

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 within 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.

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.

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.

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 socioeconomic 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 cause 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 cause 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.

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.

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, 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 groundwater. 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.

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 and human life upon impact if strong enough.

1.8 Data and Map source

The development of a comprehensive disaster risk profile requires foremost a good understanding of the general context and background of the country. Accordingly, many country data has been gathered. These data were organized in a dataset and converted into GIS formats. The data includes 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 subsequent page demonstrates a table detailing data collected from different institutions, governmental, international organization and UN Agencies.

Table 1.1: Database Inventory

S/N	Type of data	Format	Content	Source
1	DEM	Point-based GIS shapefiles	Digital elevation model of 10 meter	BWDB
2	Topographic Maps	Image	Images covering the specific area produced in 2010	SoB
3	Land Cover Map	GIS Shapefiles	Land use land cover information	MoL

4	Education facilities location	GPS locations	Specific locations and other related information	GPS survey
5	Health facilities location	GPS locations	Specific locations and other related information	GPS survey
6	Administrative boundary	GIS Shapefiles	Admin boundary with Geocode	BBS
7	River Network	GIS Shapefiles	Detail river network with the name	BWDW
8	Meteorological data	Spreadsheet	Daily Temperature, Rainfall, Humidity with station location's latitude and longitude	BMD
9	Demographic data	Spreadsheet	mauza specific Various demographic related data	BBS
10	Soil salinity	Point-based GIS shapefiles	Salinity measurement for the specific location of the study area	BARC
11	Disaster information	Spreadsheets	Various disaster and damage related information	Field survey

Chapter 2

Methodological Framework for Hazard and Risk Assessment

2.1 Understanding the 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.). This process also includes the collection of historical disaster events and the damage 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 with 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 at a different time. To identify the different hazards in a particular district one questionnaire form was produced to collect the data from the field and compiled together. The table shows the disaster calendar for the Lakshmipur district.

Upazila Name	Disaster Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kamalnagar	Cyclone			Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Excess Rainfall					Y	Y	Y	Y				
	Flood					Y	Y	Y	Y	Y			
	River Erosion							Y	Y	Y	Y		
	Thunderstorm			Y	Y	Y	Y	Y	Y	Y	Y		
	Tidal Bore			Y	Y	Y	Y	Y	Y	Y	Y		
	Water Logging				Y	Y							
	Windstorm				Y	Y							
Lakshmipur Sadar	Cyclone			Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Excess Rainfall					Y	Y	Y	Y				
	Flood					Y	Y	Y	Y	Y			

Upazila Name	Disaster Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	River Erosion							Y	Y	Y	Y		
	Thunderstorm			Y	Y	Y	Y	Y	Y	Y	Y		
	Tidal Bore			Y	Y	Y	Y	Y	Y	Y	Y		
	Water Logging				Y	Y							
	Windstorm				Y	Y							
Raipur	Cyclone				Y	Y	Y	Y	Y	Y	Y		
	Excess Rainfall							Y	Y	Y			
	Flood							Y	Y	Y	Y	Y	
	River Erosion							Y	Y				
	Thunderstorm				Y	Y							
	Windstorm				Y	Y							
Ramganj	Cyclone				Y	Y	Y	Y	Y				
	Excess Rainfall					Y	Y	Y	Y	Y			
	Flood							Y	Y				
	Thunderstorm			Y	Y	Y	Y	Y	Y	Y	Y		
	Tidal Bore		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Windstorm				Y	Y	Y						
Ramgati	Cyclone				Y	Y	Y	Y	Y	Y	Y	Y	
	Excess Rainfall					Y	Y	Y	Y	Y			
	Flood						Y	Y	Y	Y	Y	Y	
	River Erosion				Y	Y	Y	Y	Y	Y			
	Thunderstorm			Y	Y	Y	Y						
	Windstorm				Y	Y							

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 Bhola District namely, cyclone, thunderstorm, coastal flood and windstorms. 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 the 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 risk in this study also labeled as sectors of activity, are population, building, critical facilities such as health and education facilities, infrastructure (e.g. roads) and agriculture (Table 2.1). Exposure was quantified and expressed as the number of disasters affects the community (or human lives).

Table 2.1: Elements considered in the assessment per hazard

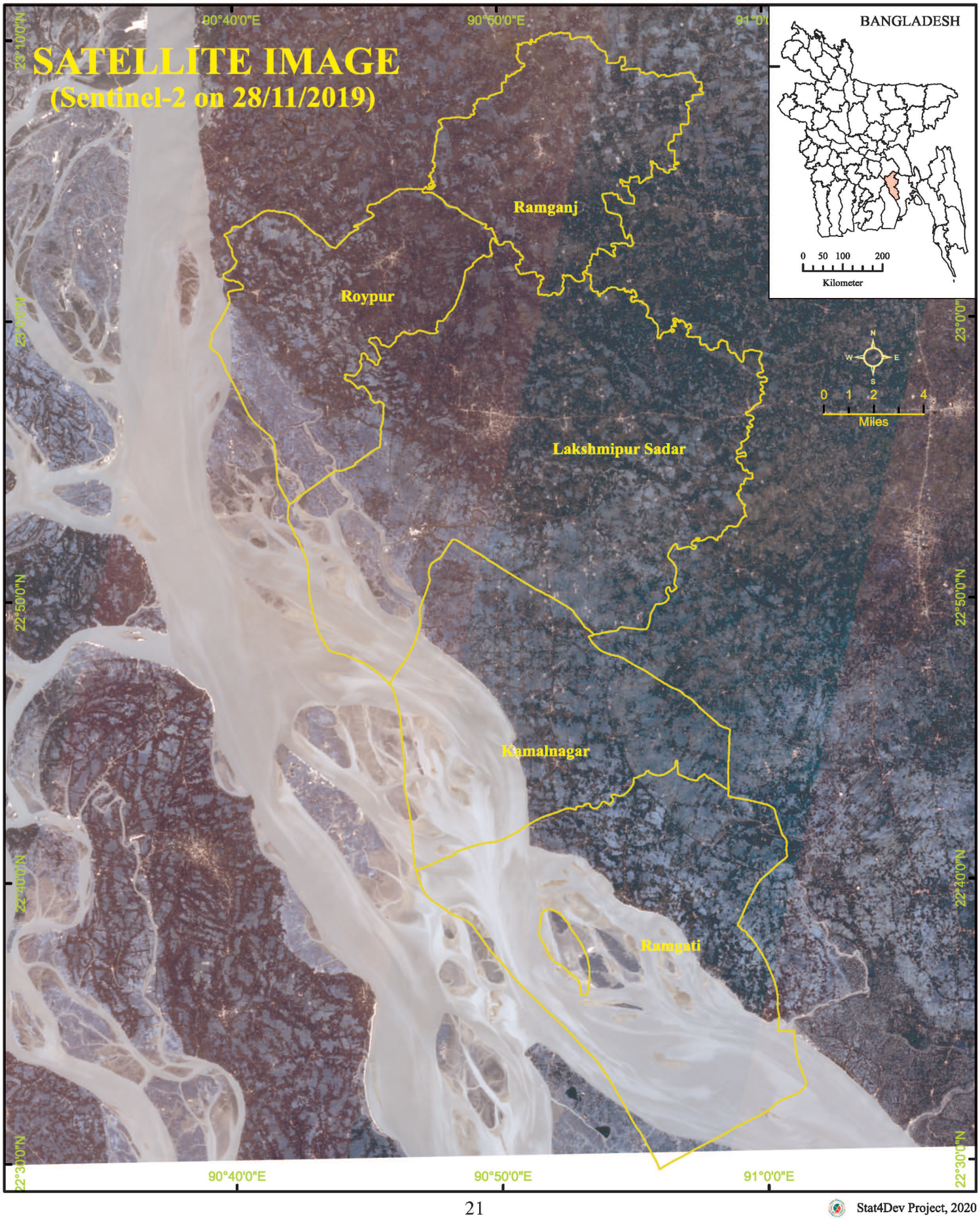
Type	Population	Settlement
Drought	√	
Flood	√	√
Landslide	√	√
Windstorm	√	√
Coastal flood	√	√
Thunderstorm	√	√
Cyclone	√	√
Salinity	√	√
Excess Rainfall	√	√
Strom surge/tidal bore	√	√
Waterlogging	√	√
Tornado	√	√
Earthquake	√	√

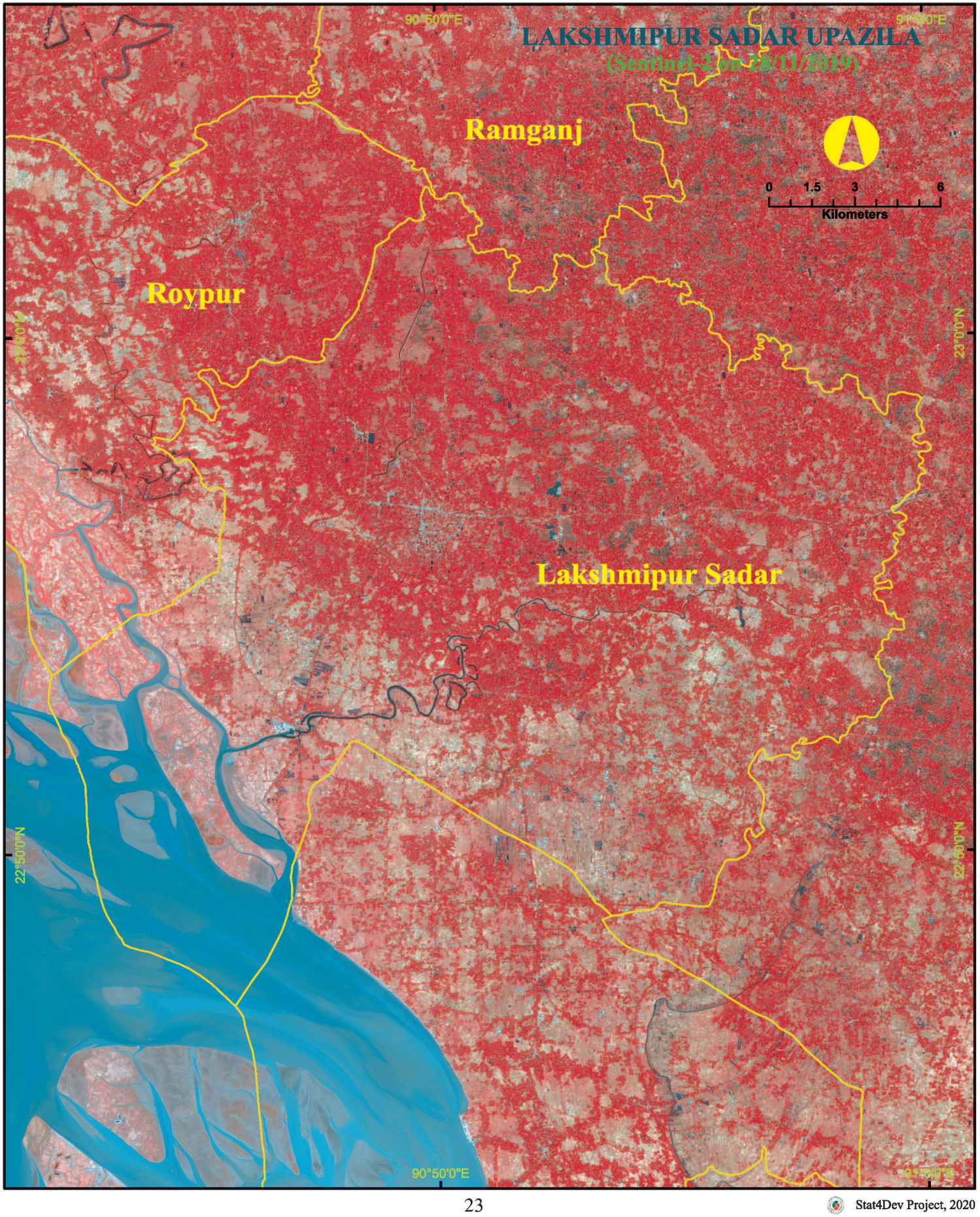
The exposure assessment is aimed at creating a national database of elements at risk. It qualifies the elements located in hazard-prone areas. The goal is to develop a comprehensive profile of elements at risk and analysis of their exposure to various natural hazards. The analysis is carried out based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

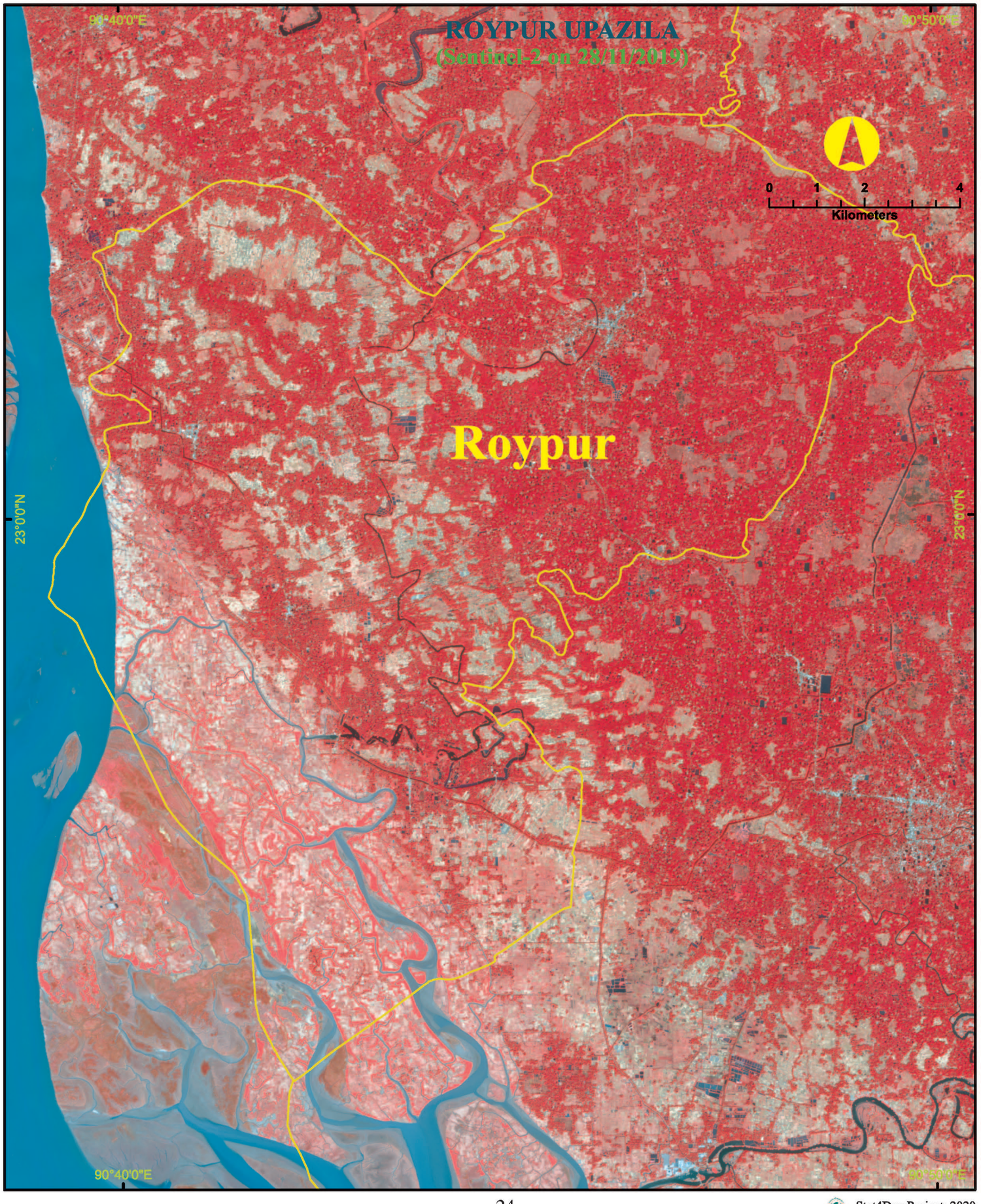
2.5 Satellite Imagery and processing

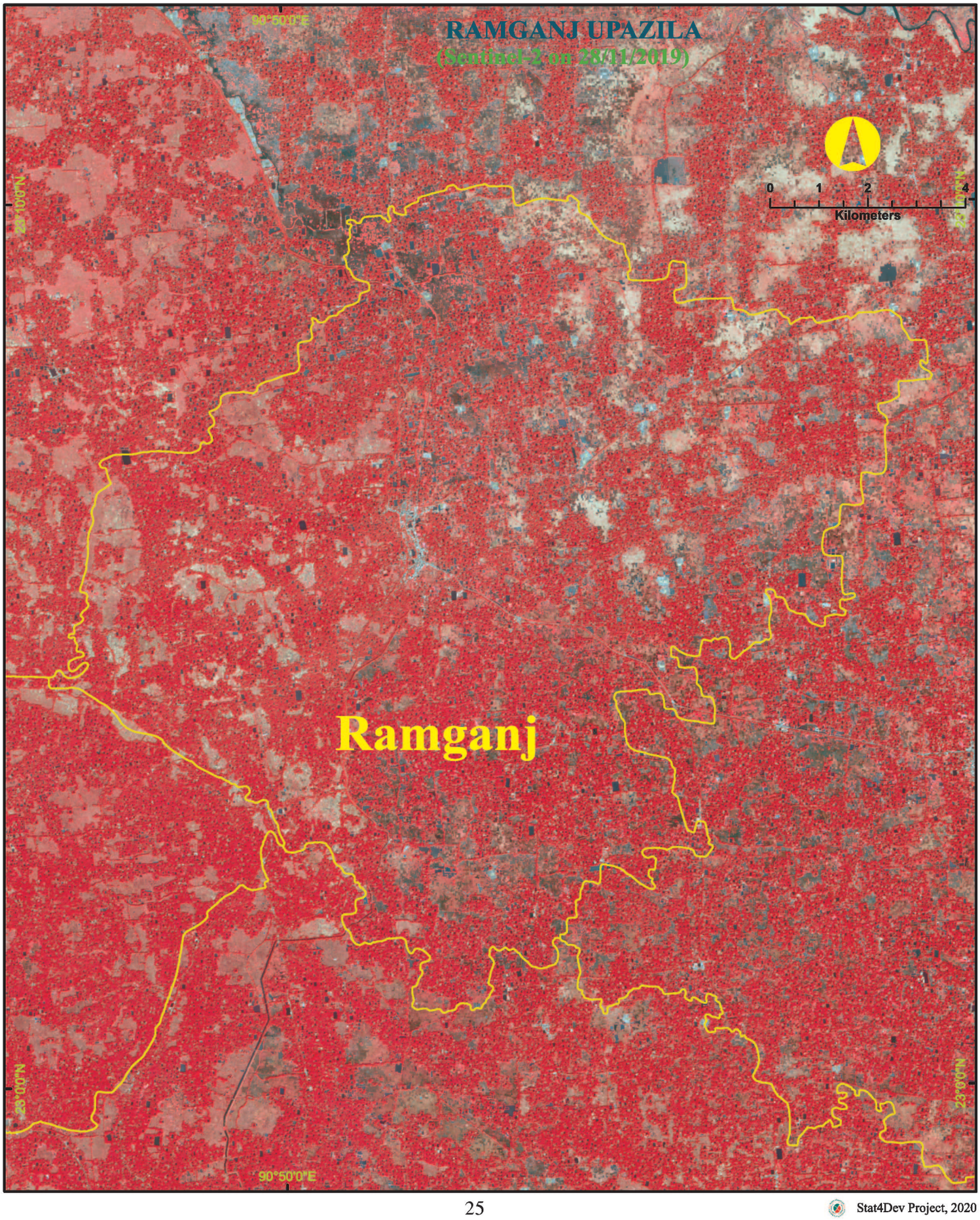
The cloud-free multi-spectral LANDSAT 5 TM images of 1989 and Sentinel-2A image of 2019 were used for bank line detection of the Meghna River. The LANDSAT 5 TM image has 7 bands with an 8-bit radiometric resolution and the spatial resolution was 15 meters. On the other hand, the Sentinel-2A image has 13 bands with 16-bit radiometric resolution and the spatial resolution was 10 meters. The most familiar water indices NDWI was used to detect the land-water boundary for the Meghna river. Moreover, to visualize the whole district, the true color composition on Sentinel-2A was used but for individual Upazila level, the false-color composition was used, where homestead vegetation showed in red color.

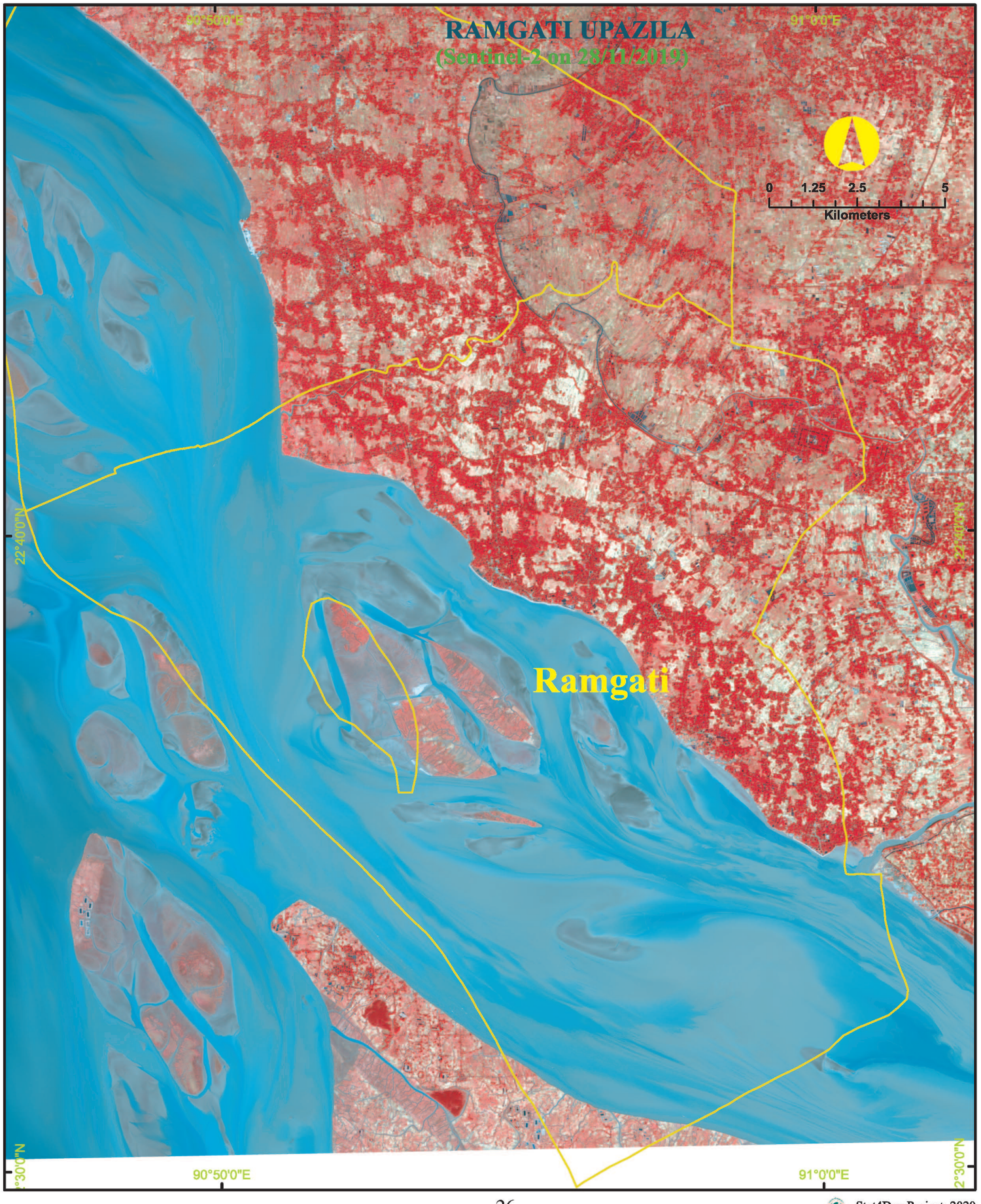
Satellite Imagery and processing


SATELLITE IMAGE
(Sentinel-2 on 28/11/2019)
BANGLADESH
0 50 100 200
Kilometer
Ramganj
Roypur
Lakshmipur Sadar
Kamalnagar
Ramgati
N
W
E
S
0 1 2 4
Miles
90°40'0"E
90°50'0"E
91°0'0"E
23°10'0"N
23°0'0"N
22°50'0"N
22°40'0"N
22°30'0"N









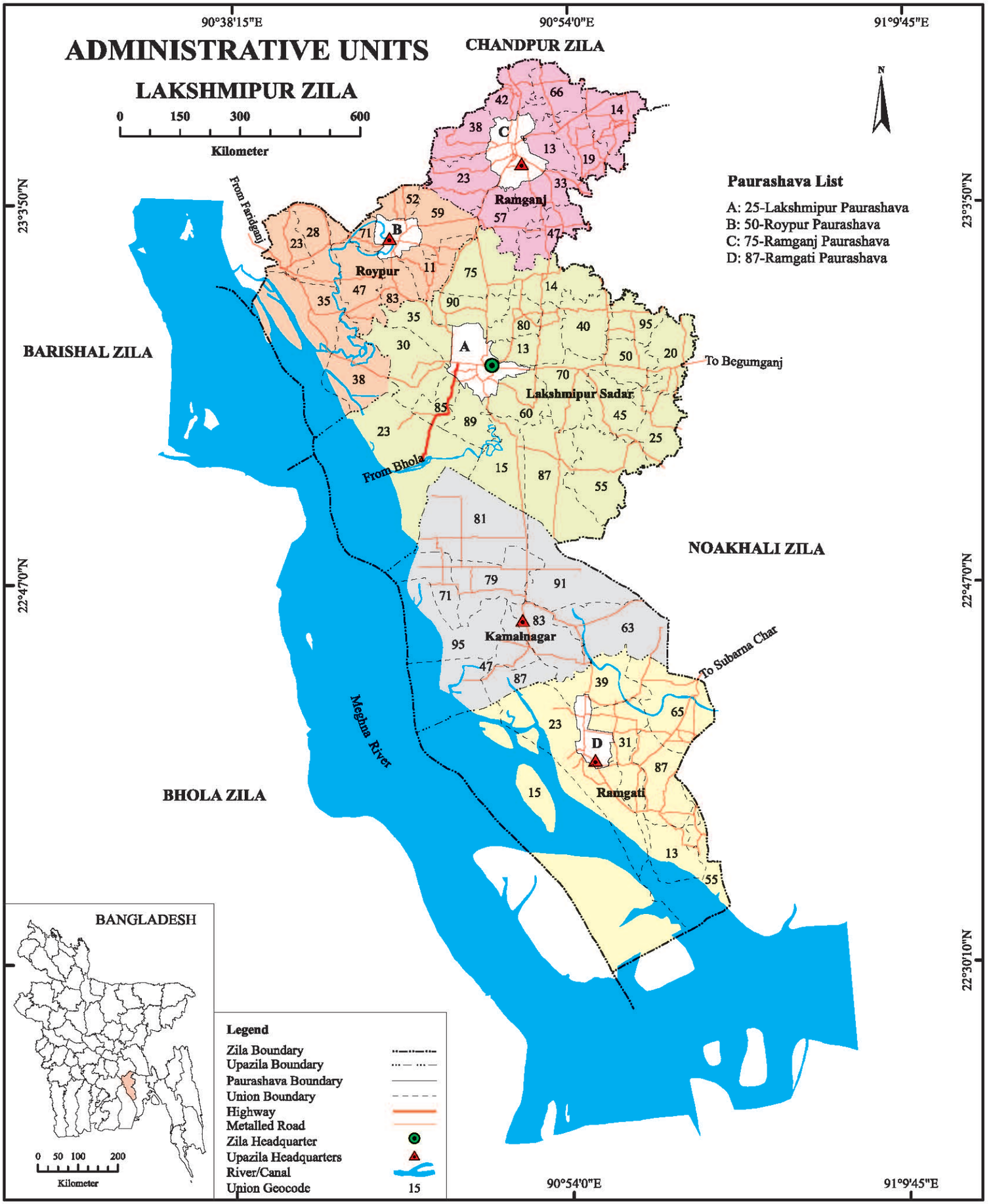
Chapter 3

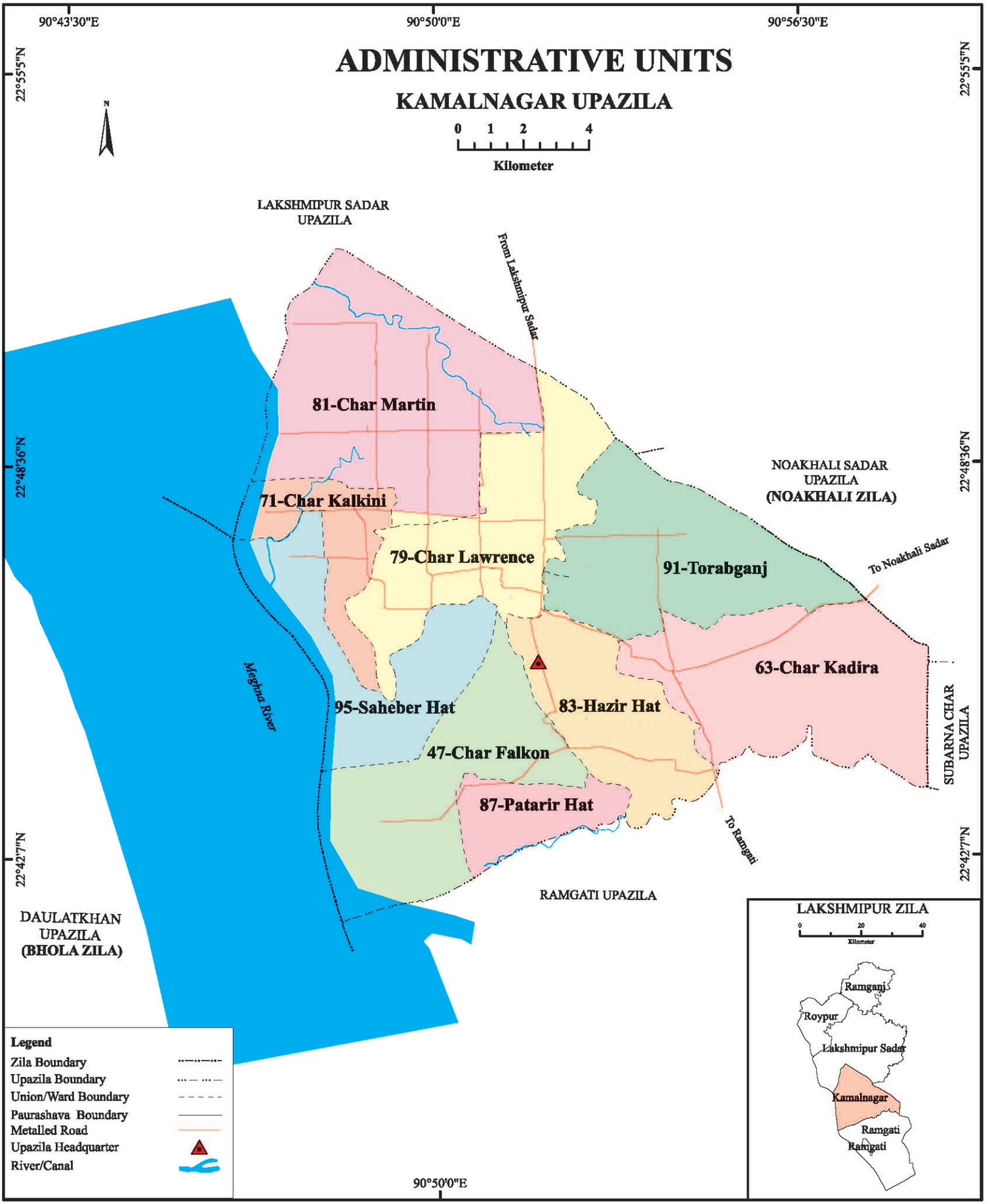
Basic Data and Base Maps of Lakshmipur District

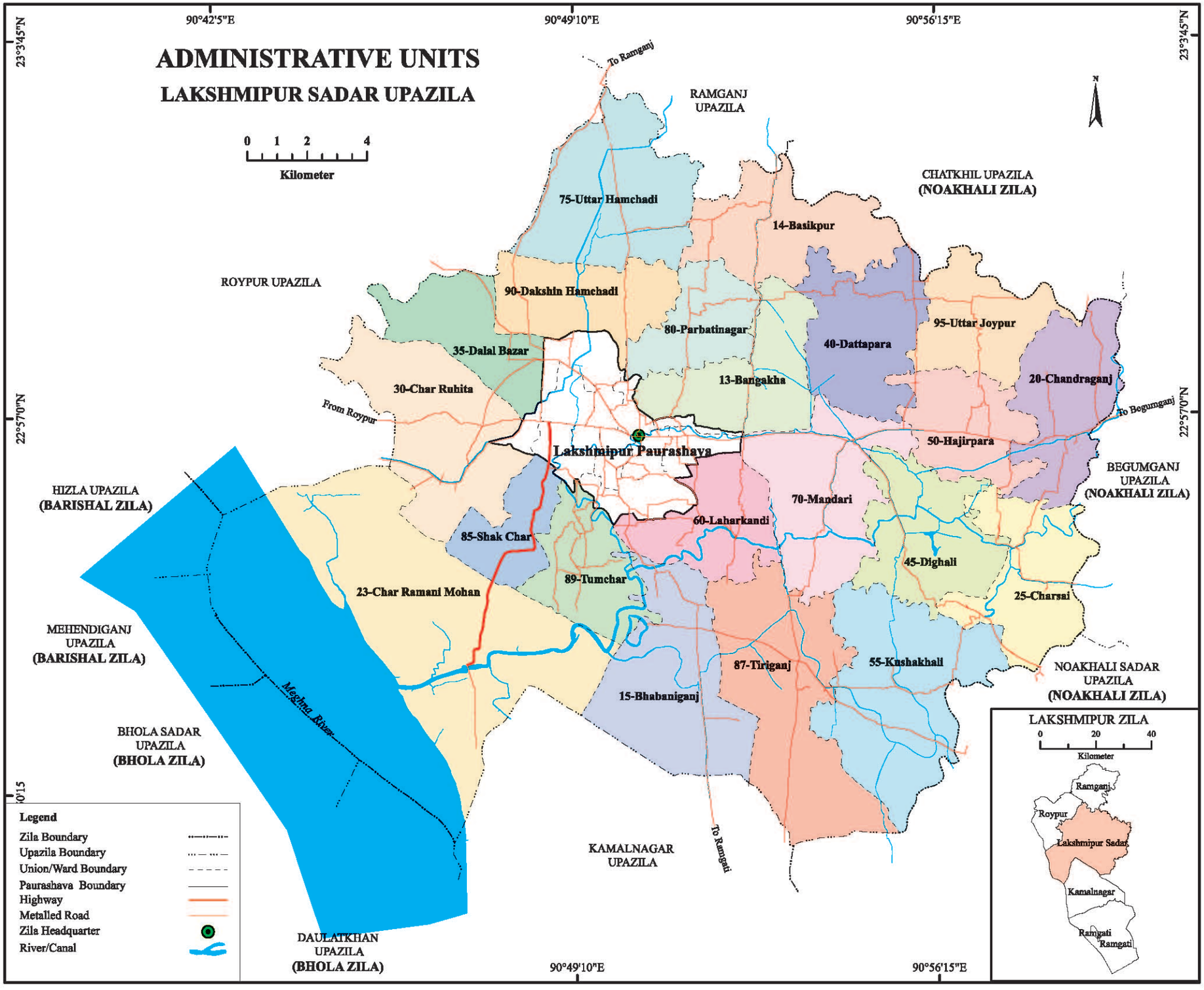
3.1 Geography and administrative division

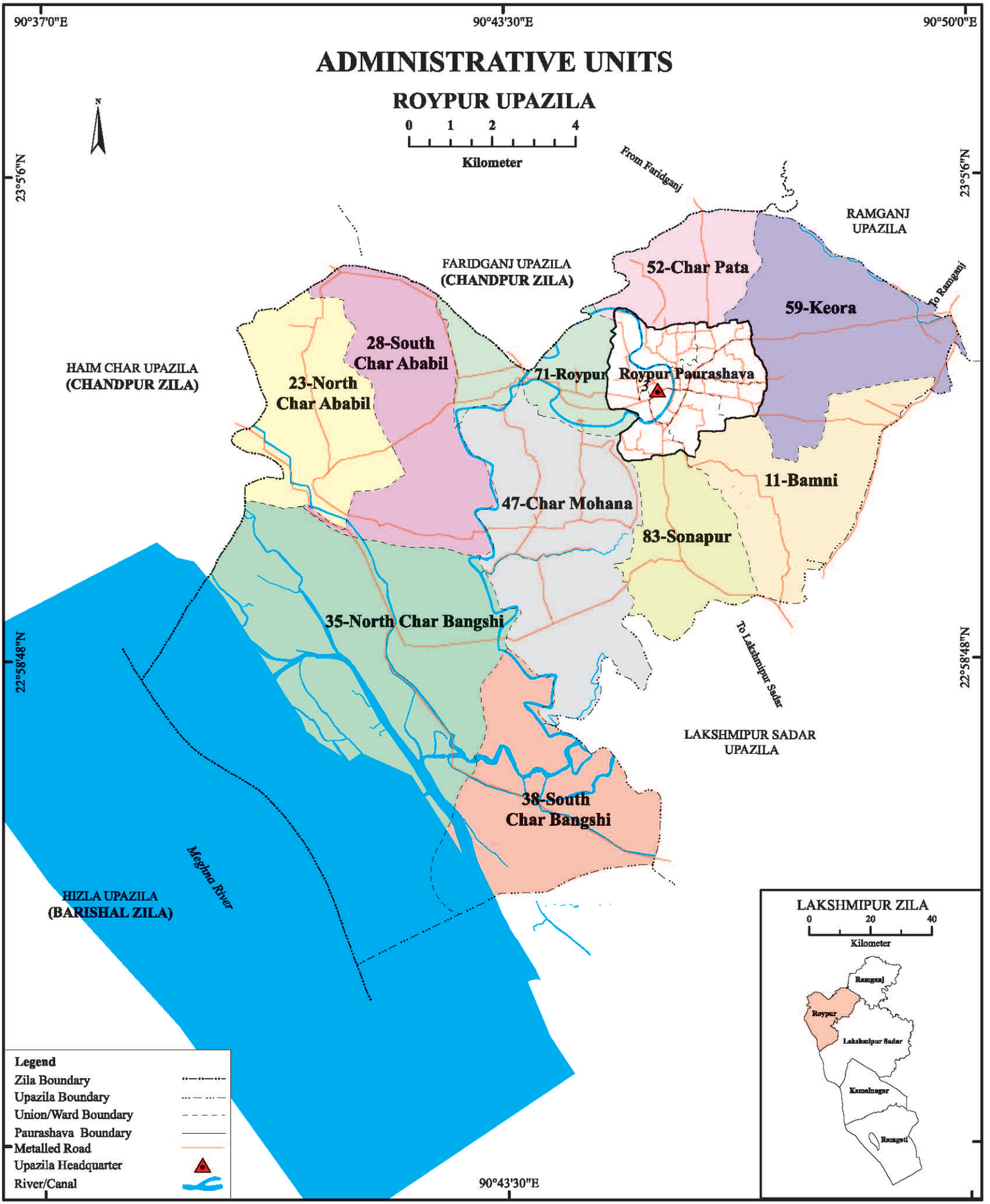
Lakshmipur was formerly a sub-division of the Noakhali district, separated as a district in 1984. The district is surrounded on the north by Chandpur district, on the east by the Noakhali district, on the south by Bhola district and the west by Barishal and Bhola districts with Meghna River. It lies between 22°30´ and 23°10´north latitude and between 90°38´ and 90°01´ east longitudes. Lakshmipur district consists of 5 Upazilas, 58 unions, 455 mauzas and 547 villages. It also comprised of 4 paurashavas, 39 paura wards and 66 mahallas. The total area of the district is 1,440.39 sq.km of which 2.12 sq.km is under forest and 85.82 sq.km is under the river. Lakshmipur town stands on the bank of the Rahmatkhali. Lakshmipur municipality was constituted in 1976. The area of the town is 19.50 sq km.

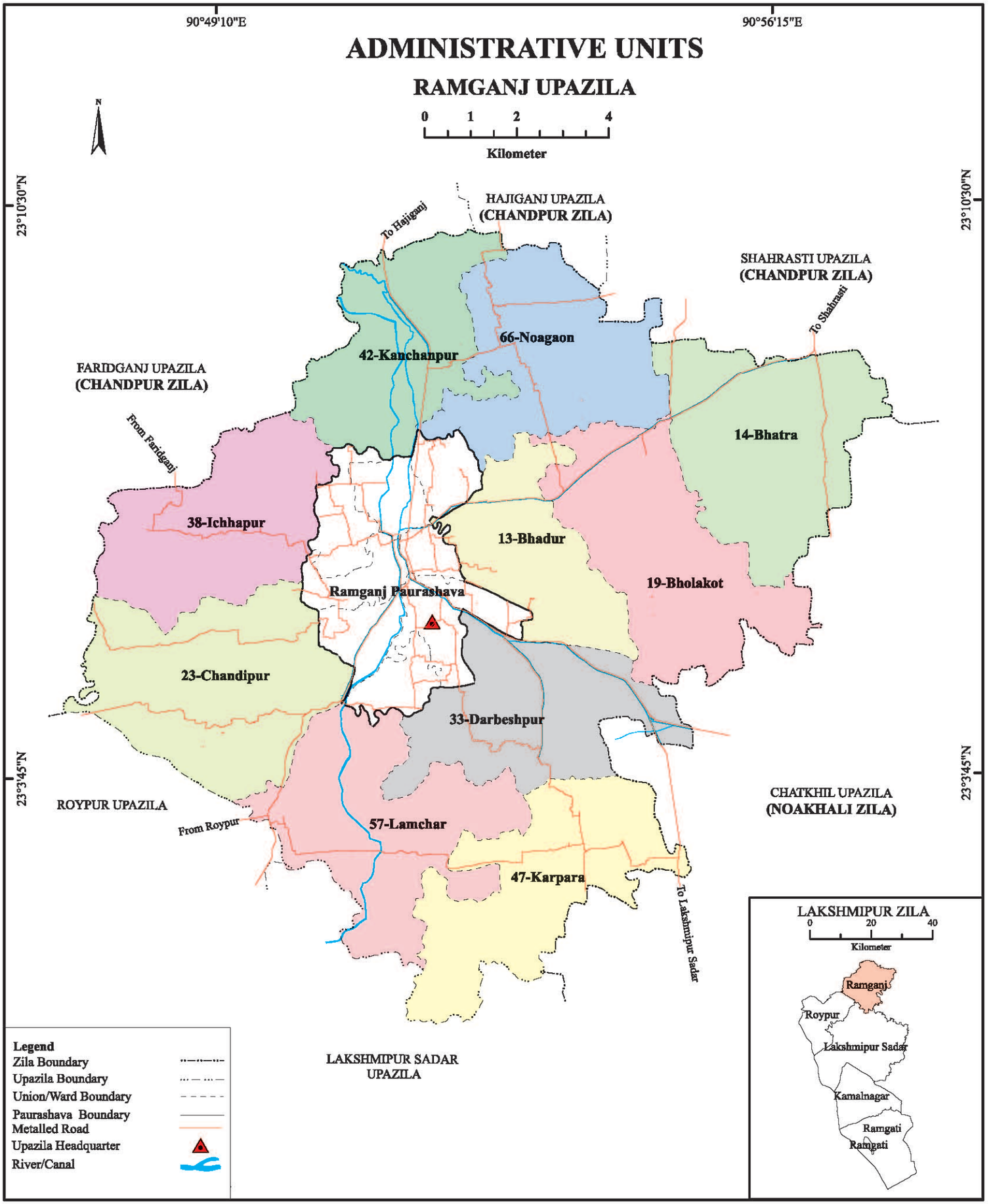
Geography and Administrative Division

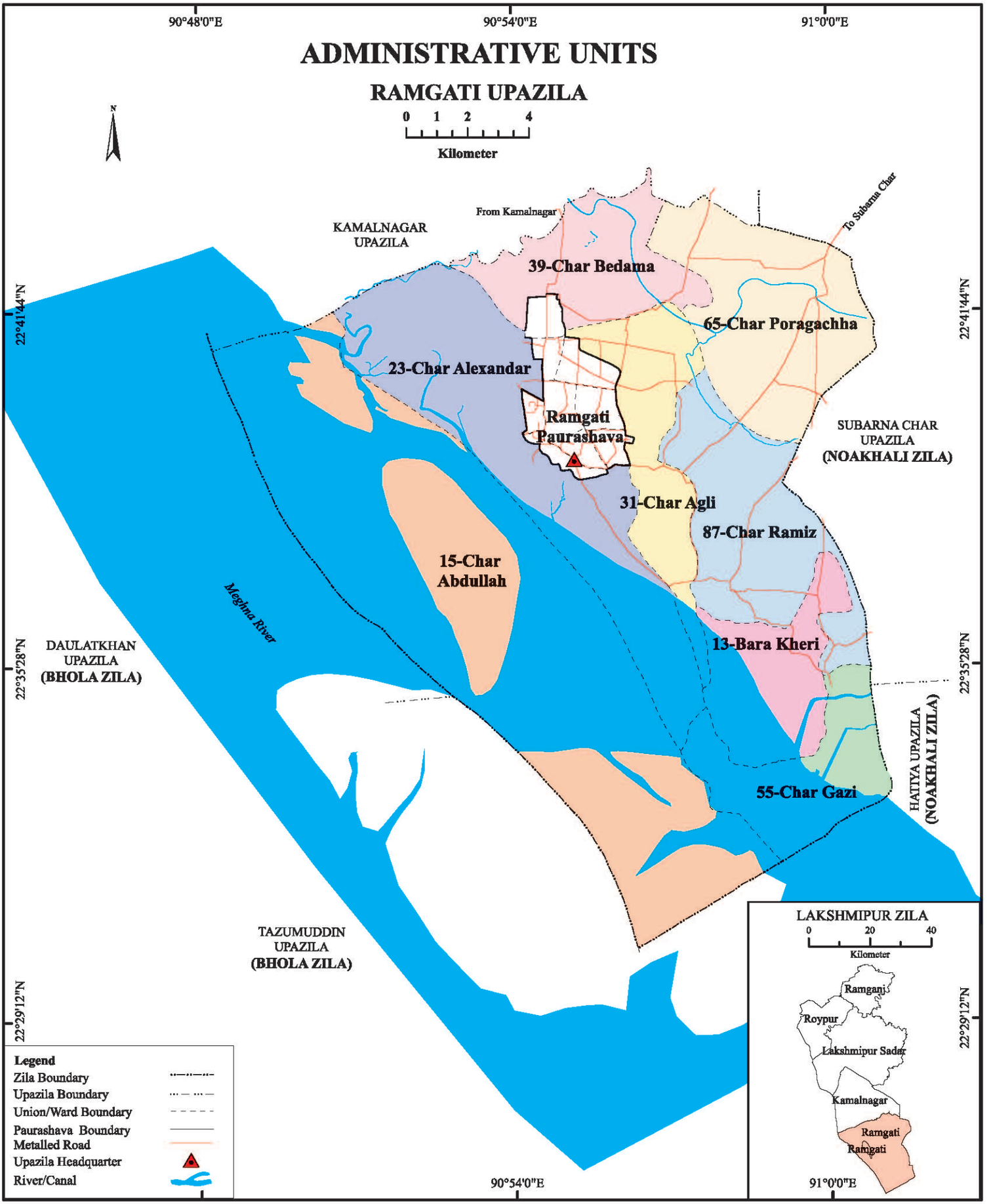












3.2 Population and Households

The total household of Lakshmipur zila, as enumerated in Population and Housing Census 2011 is 365339 of which 55201 (15.11%) are in the urban area and 310138 (84.89%) in the rural area. In respect of household type, there are 364255 (99.70%) general (dwelling), 225 (0.06%) institutional and 859 (0.24%) other households in the zila.

Table 3.1: General Household by Residence of Lakshmipur Zila, 1981 - 2011

Residence	2011		2001		1991		1981	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Zila	364255	100	285015	100	235381	100	199500	100
Urban	54743	15.03	42335	14.85	32502	13.81	18776	9.41
Rural	309512	84.97	242680	85.15	202879	86.19	180724	90.59

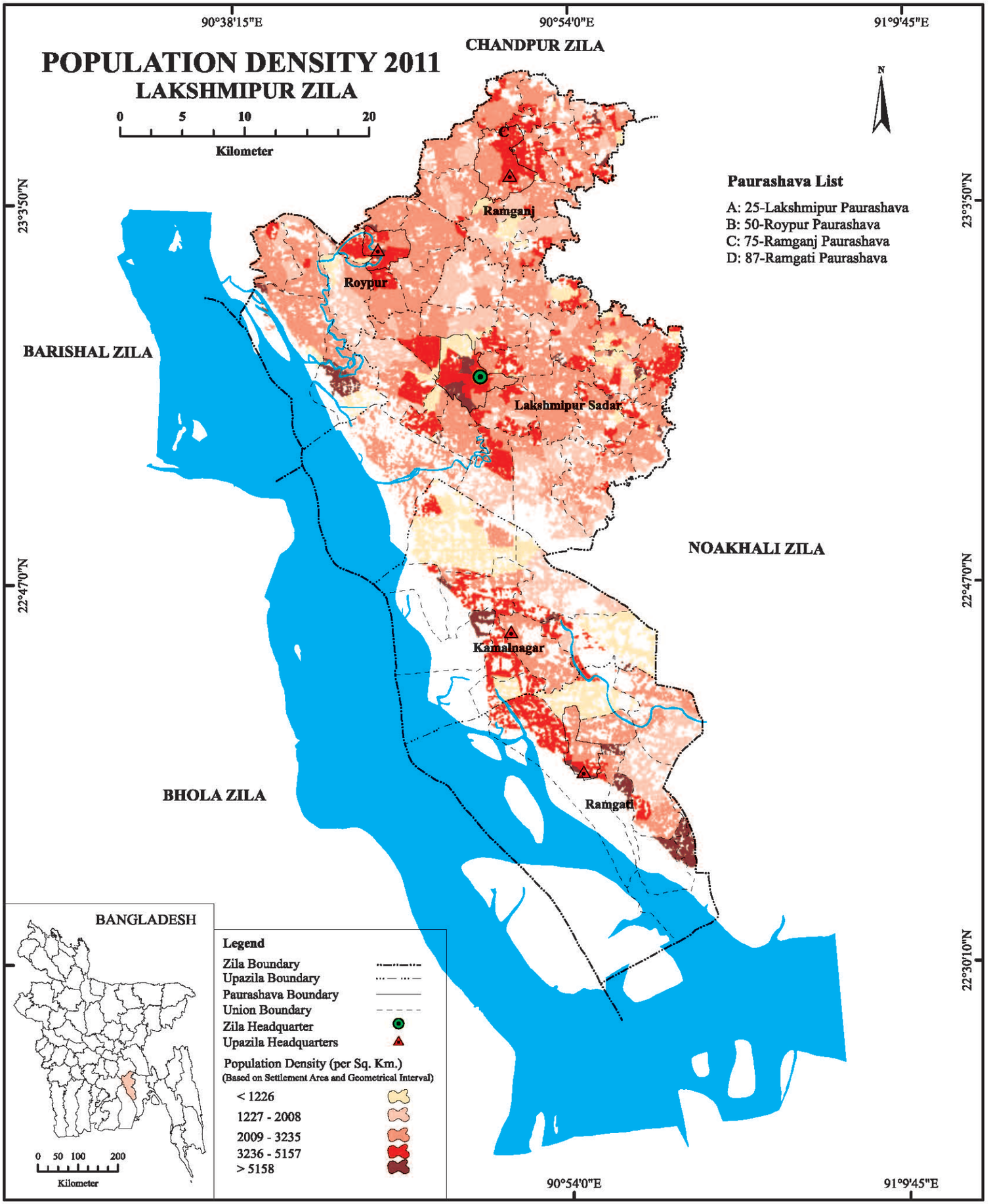
The general household has been increasing since 1981 in urban areas as well as in rural areas. The increasing trend in urban households reflects the pattern of migration from rural to the urban area. The general household in the urban area has been increasing since 1981 but its percentage showing a decreasing trend from the same year while in the rural area as an increasing trend is observed.

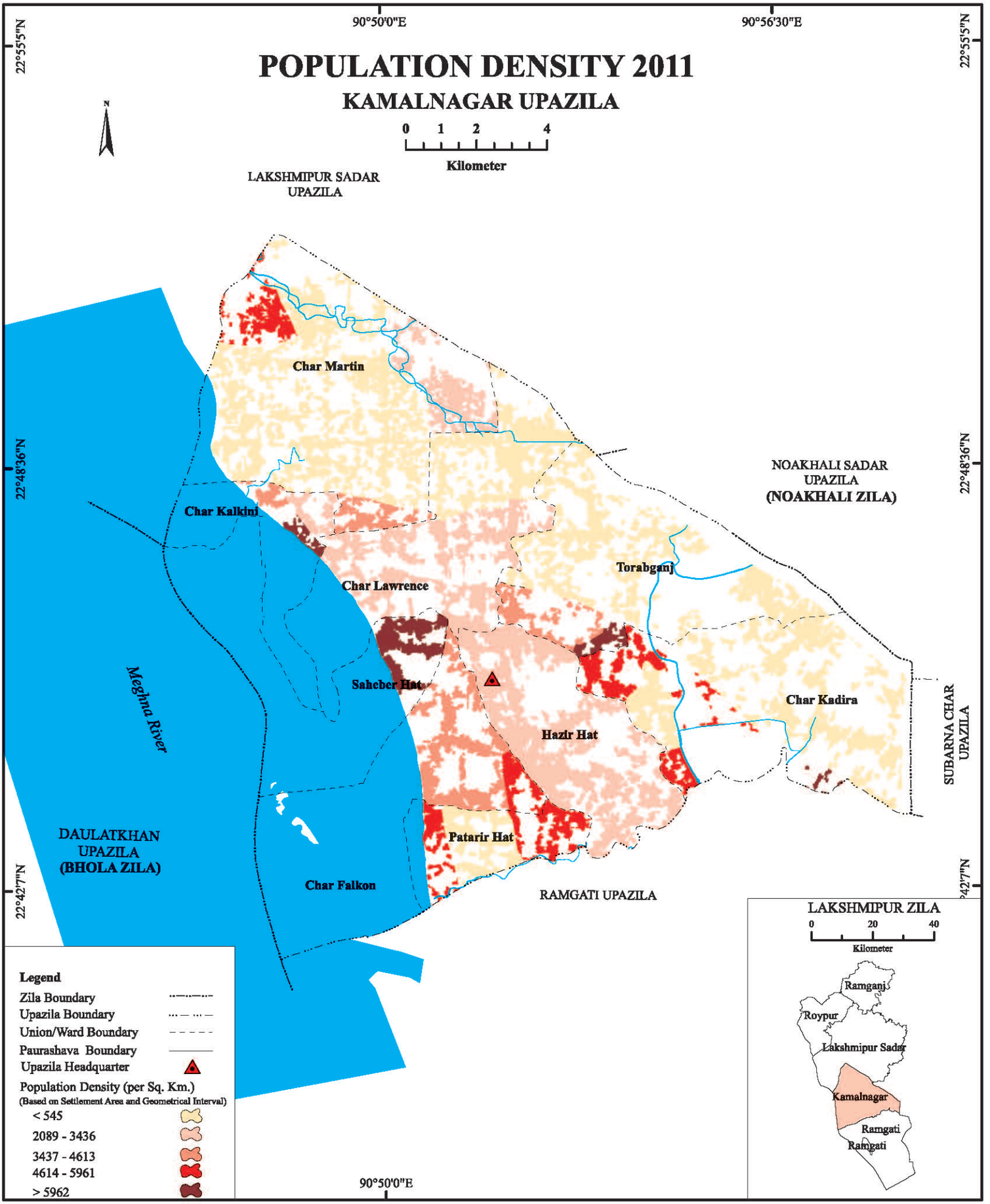
The total population of the zila, as enumerated in the 2011 Census is 1729188 of which 262997 (15.21%) constitute the urban population and the remaining 1466191 (84.79%) constitute the rural population. It is observed that the total population of both urban and rural areas has been increasing but the percent contribution to the total population by rural areas has been showing a little decreasing trend since 1974. This particular phenomenon is mainly attributed to the expansion of urban areas and possibly due to the migration of a section of people from rural areas to urban areas.

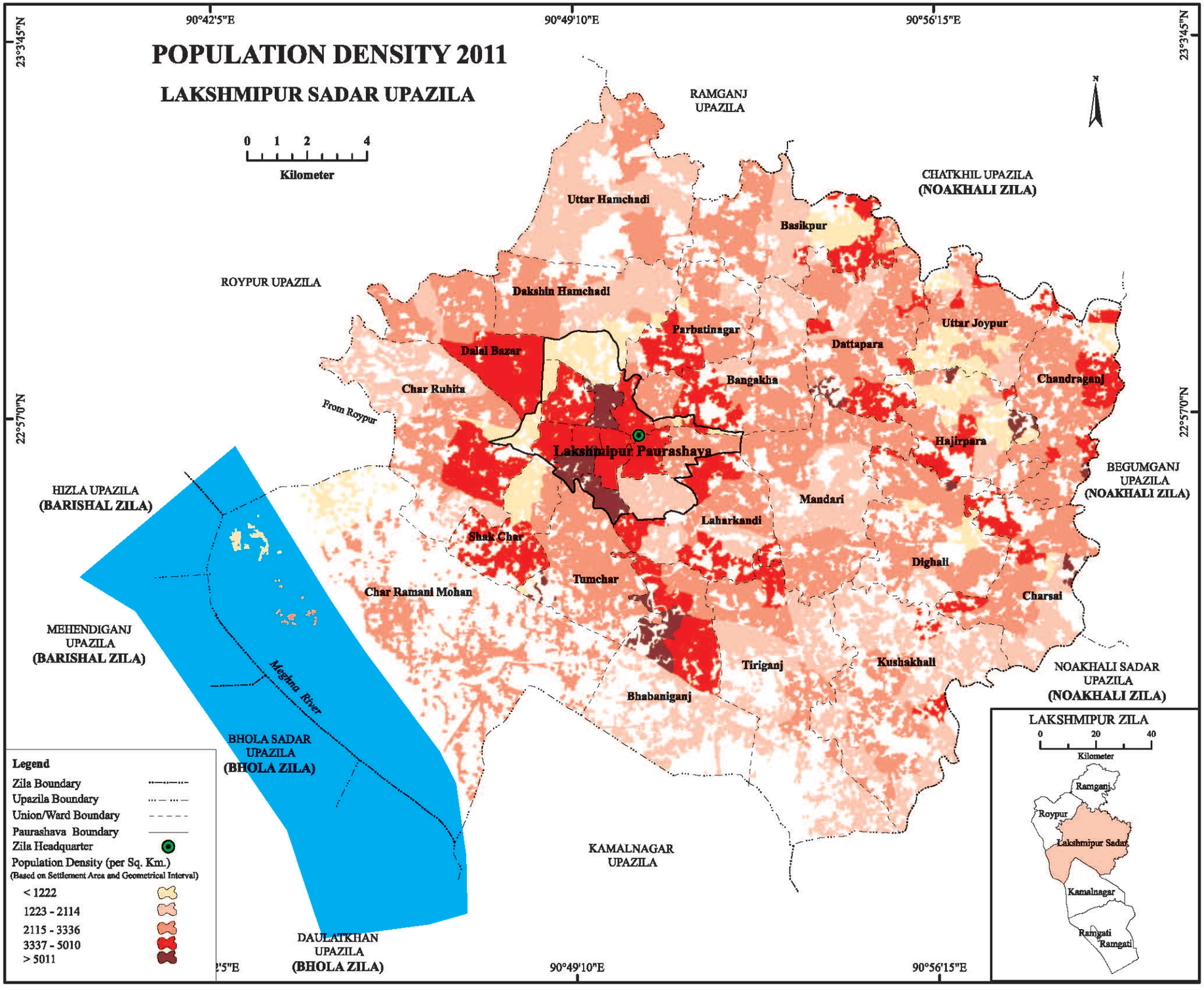
Table 3.2: General population characteristics of Lakshmipur Zila, 2011

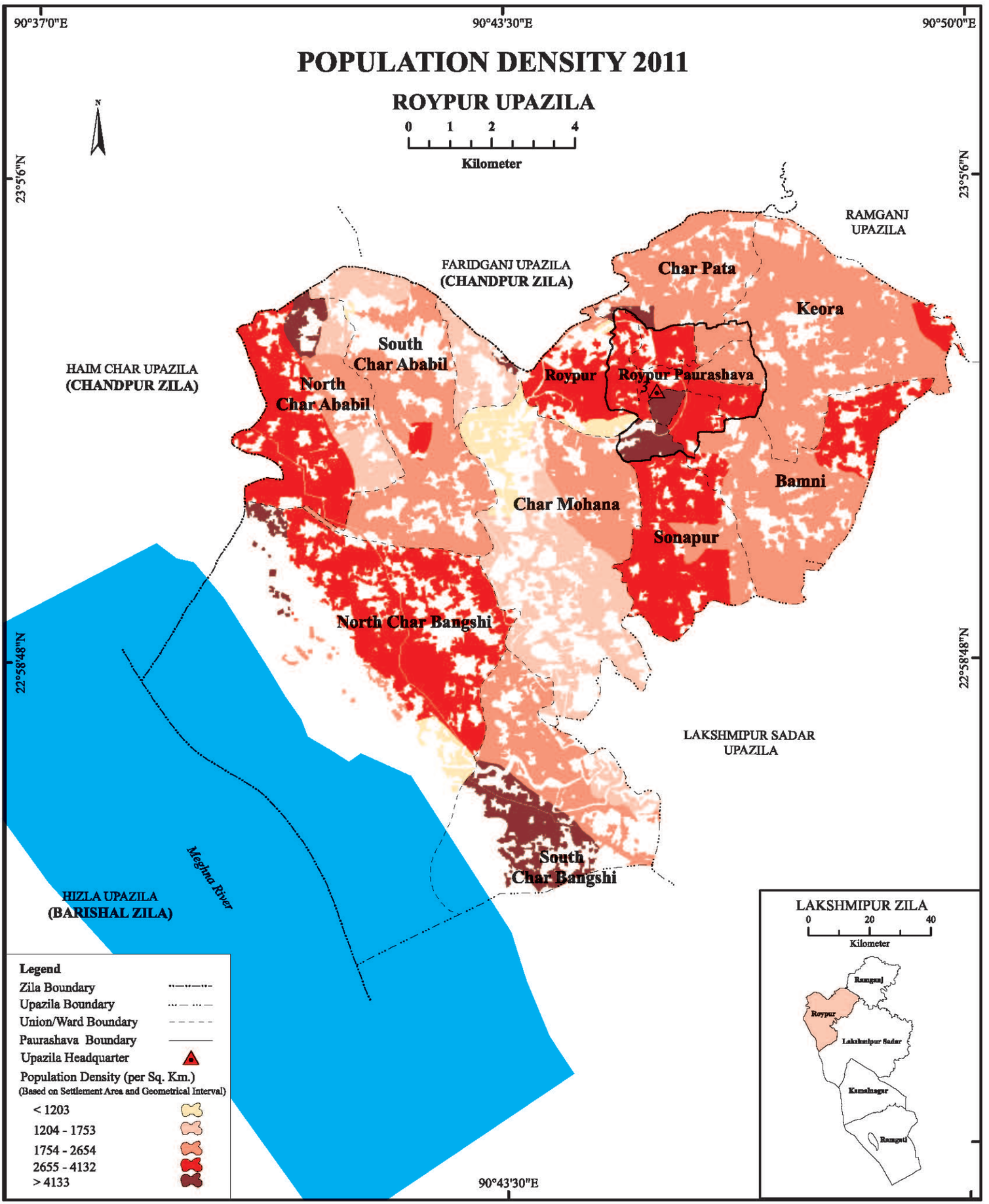
	Household	Population (000)			Sex ratio (M / F)	Average size of household	Density Per sq. Km.
		Male	Female	Both Sex			
Kamalnagar	46092	111	111	223	100	4.84	708
Lakshmipur Sadar	144228	325	359	684	91	4.71	1425
Ramganj	59285	130	155	286	84	4.79	1687
Ramgati	55644	128	133	261	97	4.68	933
Roypur	60090	132	143	275	93	4.56	1404
Total	**365339**	**826**	**901**	**1729**	**92**	**4.71**	**1200**

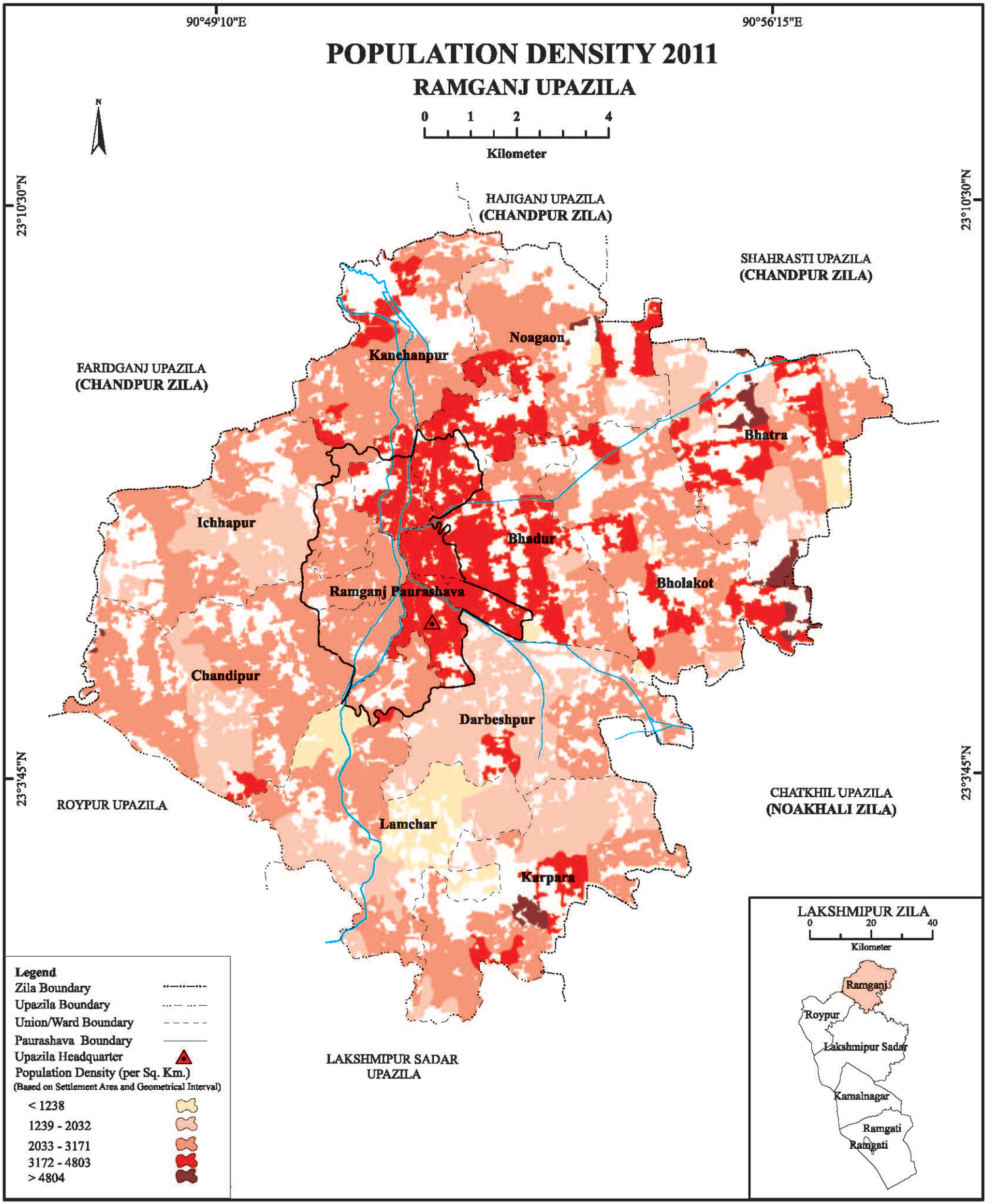
Population and Households

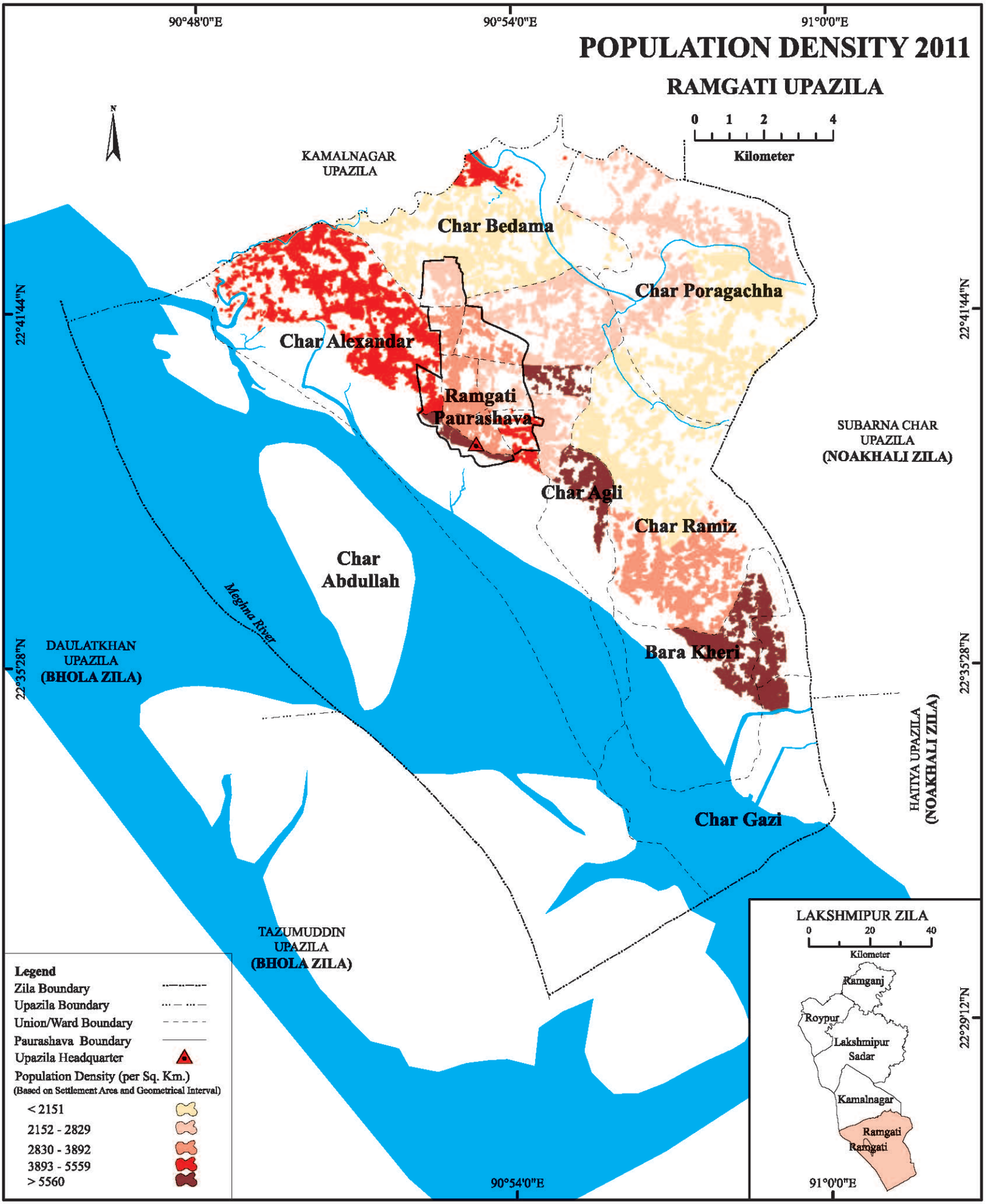












3.3 Climate

The Lakshmipur lies at 10m above sea level. The climate is tropical in Lakshmipur. During most months of the year, there is significant rainfall in Lakshmipur. There is only a short dry season. This location is classified as Am by Köppen and Geiger. In Lakshmipur, the average annual temperature is 25.7 °C. The average annual rainfall is 2547 mm. The driest month is January. There is 6 mm of precipitation in January. Most precipitation falls in July, with an average of 545 mm. With an average of 29.1 °C, May is the warmest month. In January, the average temperature is 19.3 °C. It is the lowest average temperature of the whole year. The precipitation varies 539 mm between the driest month and the wettest month. The average temperatures vary during the year by 9.8 °C.

Table 3.3: General Climatic characteristics of Lakshmipur district.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	19.3	21.8	25.9	28.3	29.1	28.3	28	28	28.3	27.4	23.9	20.4
Min. Temperature (°C)	12.9	15.4	20.2	23.7	25.1	25.6	25.6	25.6	25.5	24	19	14.4
Max. Temperature (°C)	25.8	28.2	31.7	32.9	33.1	31.1	30.4	30.5	31.1	30.9	28.9	26.4
Avg. Temperature (°F)	66.7	71.2	78.6	82.9	84.4	82.9	82.4	82.4	82.9	81.3	75.0	68.7
Min. Temperature (°F)	55.2	59.7	68.4	74.7	77.2	78.1	78.1	78.1	77.9	75.2	66.2	57.9
Max. Temperature (°F)	78.4	82.8	89.1	91.2	91.6	88.0	86.7	86.9	88.0	87.6	84.0	79.5
Precipitation / Rainfall (mm)	6	18	46	131	273	500	545	474	321	177	47	9

Source: https://en.climate-data.org

Table 3.4: General Household by Headship and Residence, 2011

Residence	Total Household		Male Headed Household		Female Headed Household	
	No.	%	No.	%	No.	%
Zila	510780	100.00	418946	82.02	91834	17.98
Urban	112222	21.97	94720	84.40	17502	15.60
Rural	398558	78.03	324226	81.35	74332	18.65

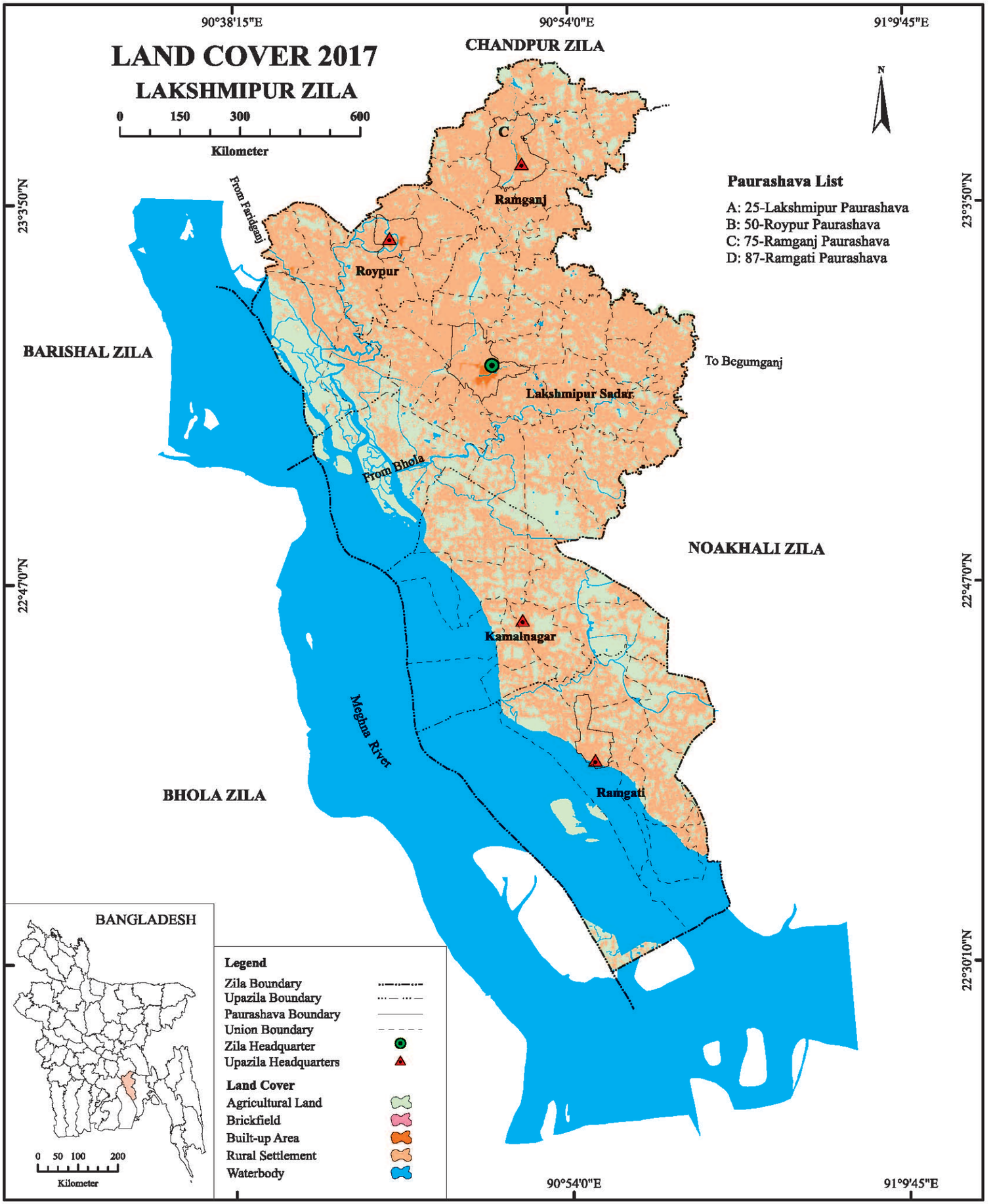
3.4 Land cover

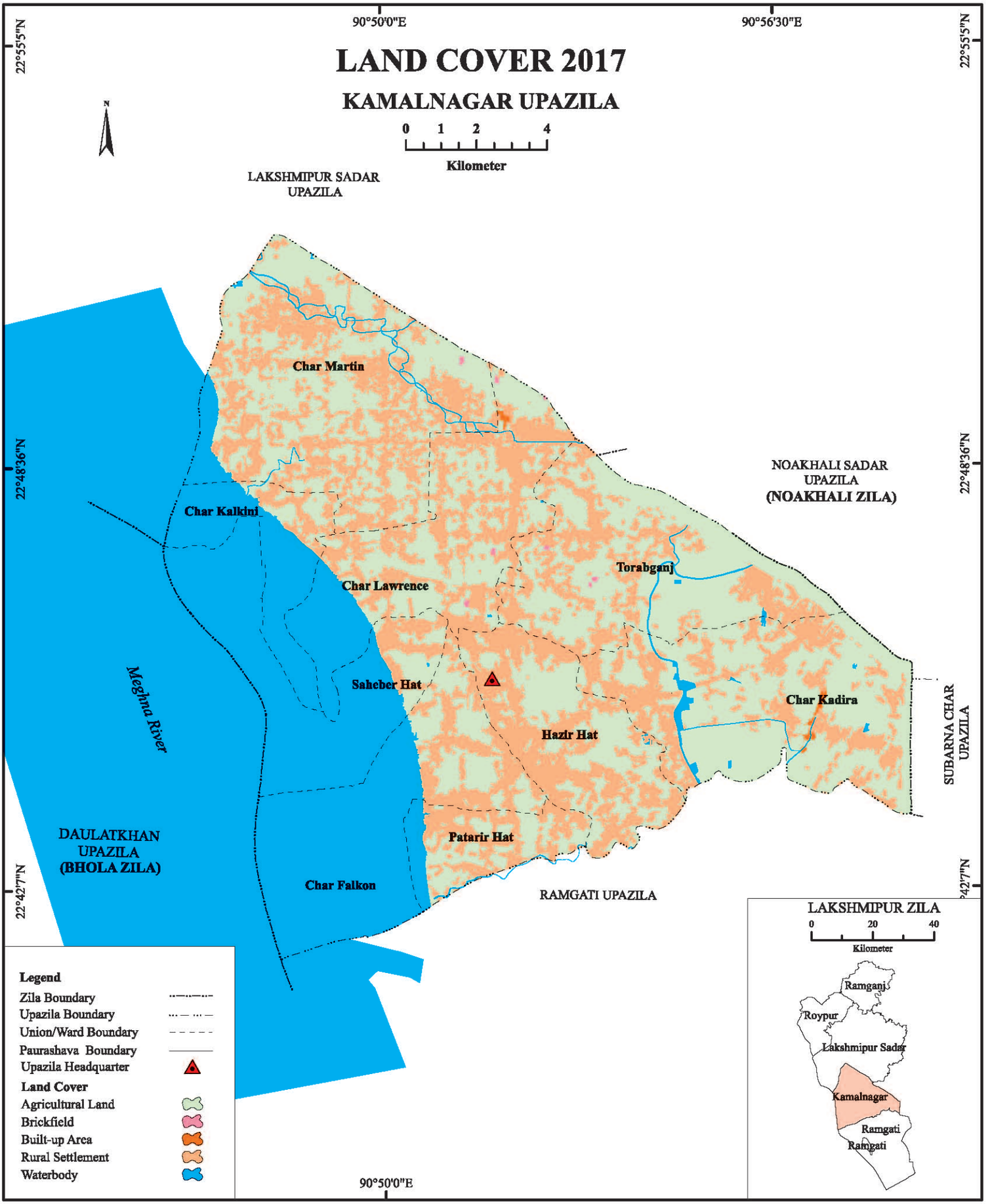
The largest Upazila is Lakshmipur Sadar with 33.3% of the total district area. On the other hand, the smallest Upazila is Ramganj with 11.8% of the total area. As of 2000, 19% of Lakshmipur was tree cover. From 2001 to 2018, Lakshmipur lost 6 ha of tree cover, equivalent to a 0.028% decrease in tree cover since 2000, and 1.07kilo ton of CO_2 emissions (www.globalforestwatch.org). The distribution of land cover of the Lakshmipur zila is given below.

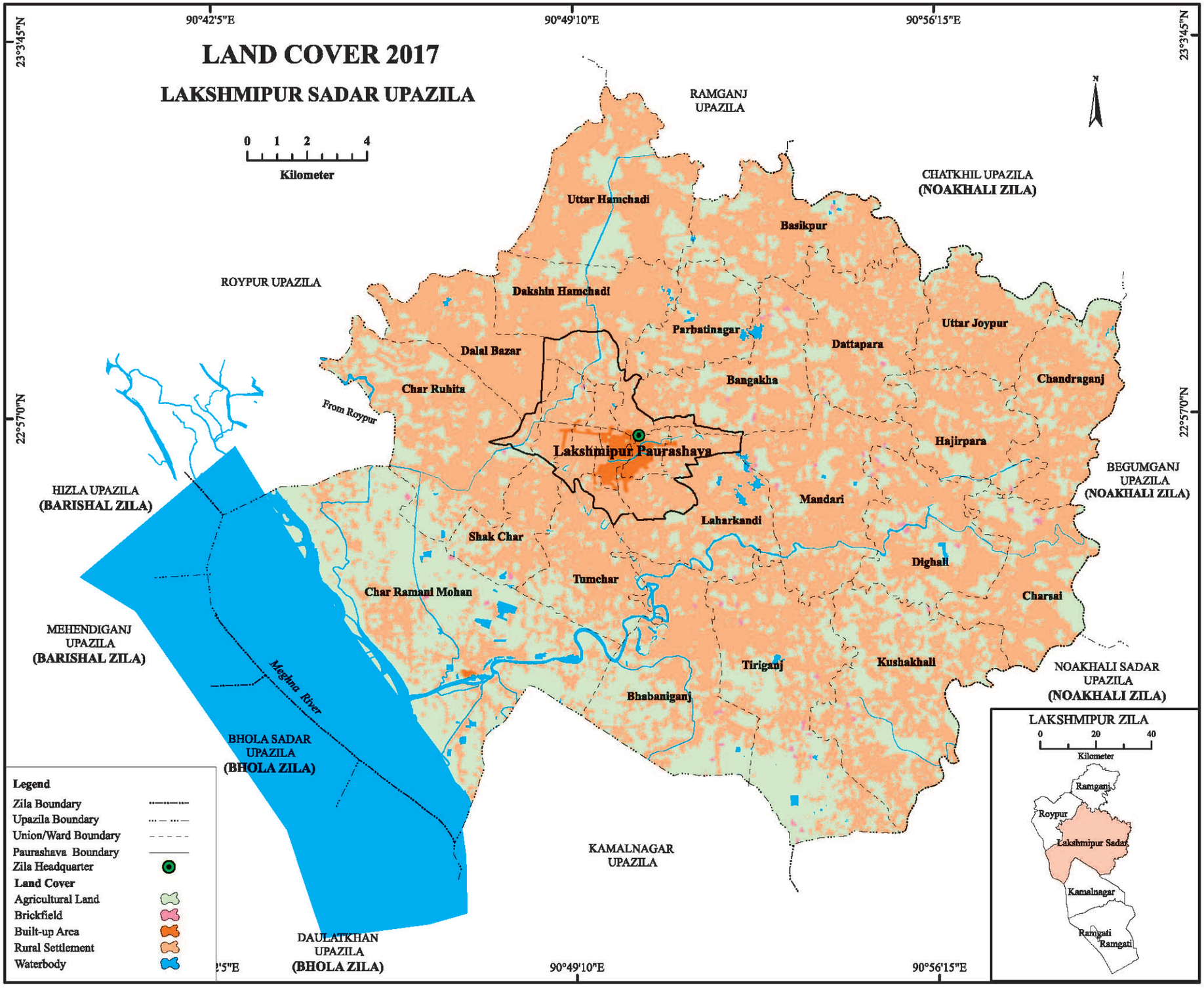
Table 3.5: Land area distribution to different Upazilas of Lakshmipur district (in sq km)

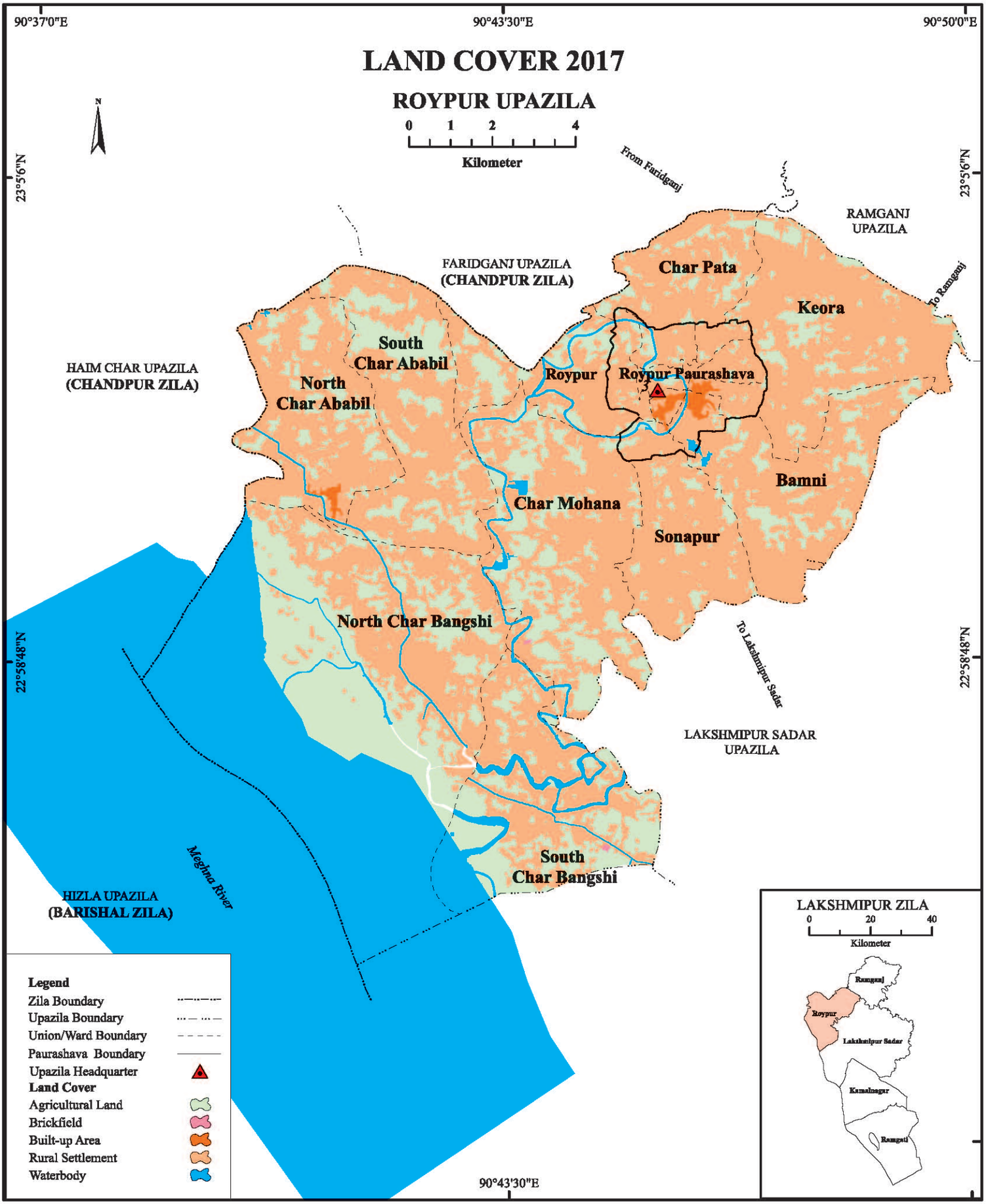
Upazila	Total area	Land area	Reserve forest	River area
Kamalnagar	314.86	304.86	0	10
Lakshmipur Sadar	480.35	475.09	0.4	4.86
Ramganj	169.31	169.31	0	0
Ramgati	279.88	214.16	1.72	64
Roypur	195.98	189.02	0	6.96
Total	**1440.38**	**1352.44**	**2.12**	**85.82**

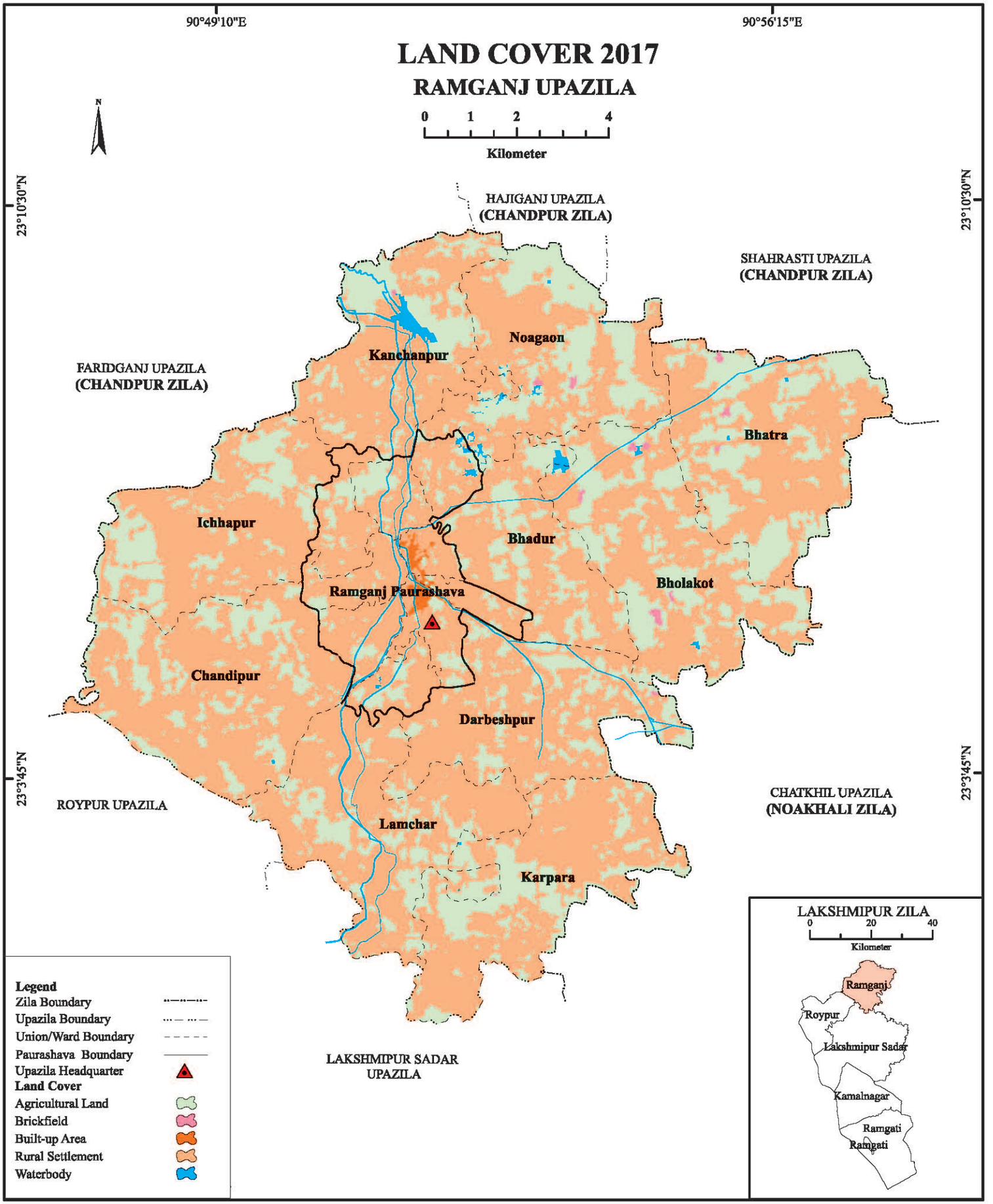
Land Cover
Area Map








LAND COVER 2017
ROYPUR UPAZILA
0 1 2 4
Kilometer
N
90°37'0"E
90°43'30"E
90°50'0"E
23°5'6"N
22°58'48"N
From Faridganj
To Ramganj
To Lakshmipur Sadar
RAMGANJ UPAZILA
FARIDGANJ UPAZILA (CHANDPUR ZILA)
HAIM CHAR UPAZILA (CHANDPUR ZILA)
HIZLA UPAZILA (BARISHAL ZILA)
LAKSHMIPUR SADAR UPAZILA
Char Pata
Keora
South Char Ababil
North Char Ababil
Roypur
Roypur Paurashava
Bamni
Char Mohana
Sonapur
North Char Bangshi
South Char Bangshi
Meghna River
Legend
Zila Boundary
Upazila Boundary
Union/Ward Boundary
Paurashava Boundary
Upazila Headquarter
Land Cover
Agricultural Land
Brickfield
Built-up Area
Rural Settlement
Waterbody
LAKSHMIPUR ZILA
0 20 40
Kilometer
Ramganj
Roypur
Lakshmipur Sadar
Kamalnagar
Ramgati



3.5 Education

The literacy rates for both sex, male and female in the zila, urban and rural areas have been increasing since 1991 The increasing rates show that there are only 6.46, 4.69 and 8.15 percentage points in the zila, 8.49, 6.97 and 10.14 percentage points in urban and 6.08, 4.23 and 7.79 percentage points increase in the rural area for both sexes, male and female respectively during the decade 2001-2011. Therefore, this improvement is possible for the installments of educational infrastructures in different Upazilas. The following table shows the distribution of various educational establishments in Lakshmipur zila.

Table 3.6: Distribution of various educational establishments in Lakshmipur zila.

Institute Types	Kamalnagar	Lakshmipur Sadar	Ramganj	Ramgati	Roypur	Total
Government primary School	37	215	122	54	84	512
Registered primary school	29	51	36	37	29	182
Non-govt. Primary school	0	17	11	3	7	38
Kindergarten school	5	25	12	9	46	97
NGO school	3	105	0	1	79	188
Government secondary school	0	2	1	0	0	3
Non-government secondary school	13	74	31	18	28	164
School & college	0	2	3	0	0	5
Government college	0	2	1	1	1	5
Non-government college	1	8	2	3	3	17
Madrasah	14	57	27	14	20	132
Kawmi madrasah	16	21	1	15	2	55
Ebtedayee madrasah	3	16	4	11	2	36
Technical and vocational institution	0	4	1	0	0	5
Medical college	0	1	0	0	0	1

Source: BBS, 2011

3.6 Health facilities

There is no medical college hospital in Lakshmipur zila. The mass population mainly depends on community clinics. Besides this, there are few union health & family welfare centers and private clinic facilities. The following table shows the health facility types and their number in the zila.

Table 3.7: Number of health facilities in Lakshmipur zila.

Facility Type	Total No.of Facility(es)	No. of Beds
Medical College Hospital	0	0
District Hospital	1	100
General Hospital	0	0
Upazila Health Complexes	5	143
Union Sub Centers	10	0
Union Health & Family Welfare Centers (under DGHS)	11	0
Union Health & Family Welfare Centers (under DGFP)	28	0
Rural Dispensaries	0	0
Community Clinics	175	0
Trauma Centers	0	0
MCWCs (belong to DGFP)	2	20
Chest Disease (TB) Clinics/Hospitals	0	0
Private Clinics/Facilities	25	320

Source: Directorate General of Health Services, 2020

3.7 Transport

The total road length of Lakshmipur district is 6001 km, where 24.82 % is the metalled road, semi-metalled is only 3% and the rest of 72% road is the unmetalled road. A very few waterways are available with 122.21 km which increased up to 189.57 km around the year.

Table 3.8: Distribution of road types (km) of different Upazilas of Lakshmipur zila.

Upazila	Metalled road	Semi metalled road	Unmetalled (Katcha) road	Total	Waterway in Monsoon (River + Canal)	Waterway round the Year (River + Canal)
Kamalnagar	62	12	24	98	24.71	24.71
Lakshmipur Sadar	741	32	2984	3757	2.5	4.86
Ramganj	374	50	586	1010	36.4	112
Ramgati	100	52	301	453	44	24
Roypur	213	37	433	683	14.6	24
Total	1490	183	4328	6001	122.21	189.57

Source: Upazila Statistical Office, BBS, 2011

3.8 Cyclone Shelters

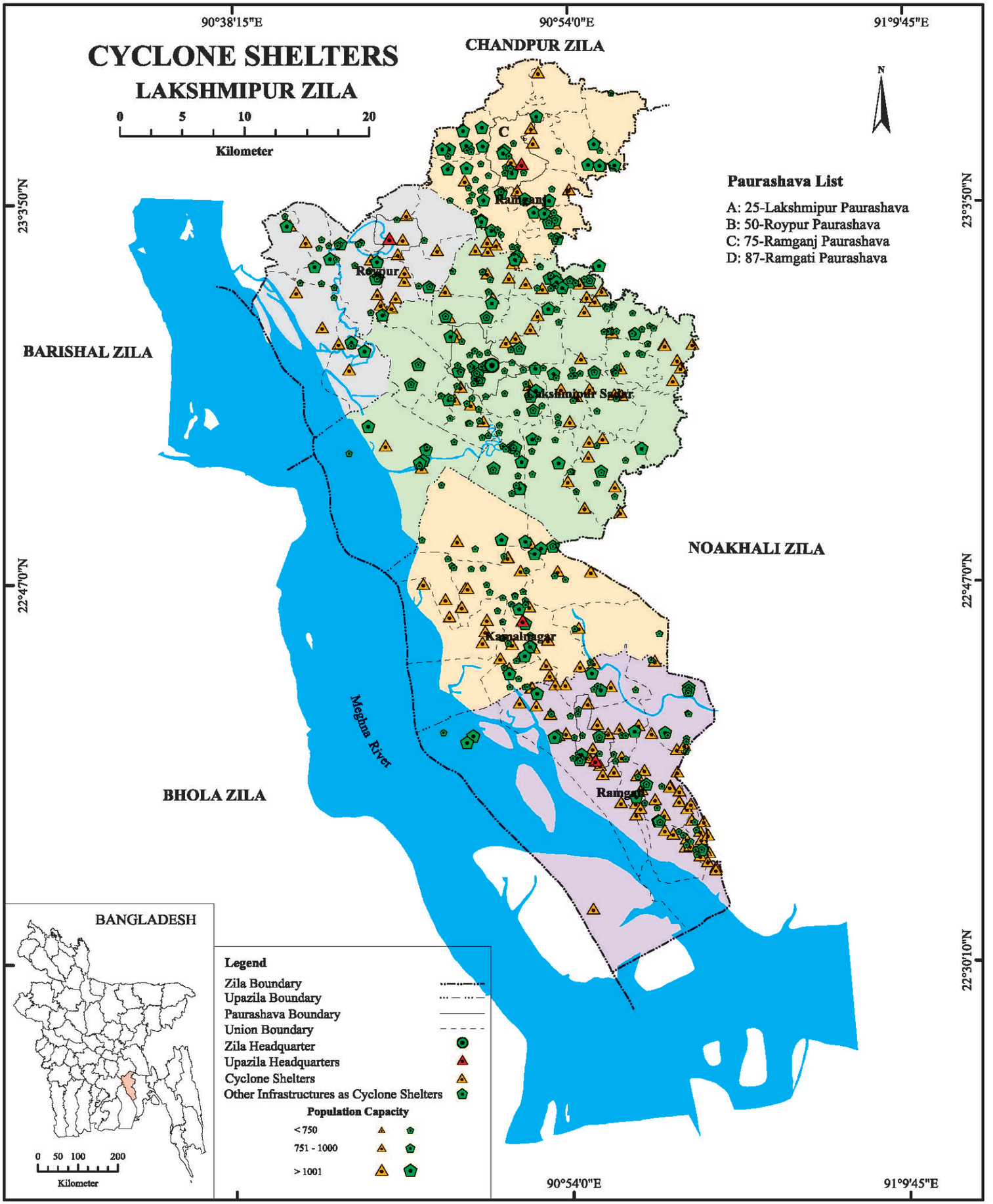
There are only 242 cyclone shelters available constructed by different Governmental and non-governmental agencies with the capacity of 588275 people. Whereas, the total population of the district is 1729000 and only 34 % of the total population may have a disaster shelter.

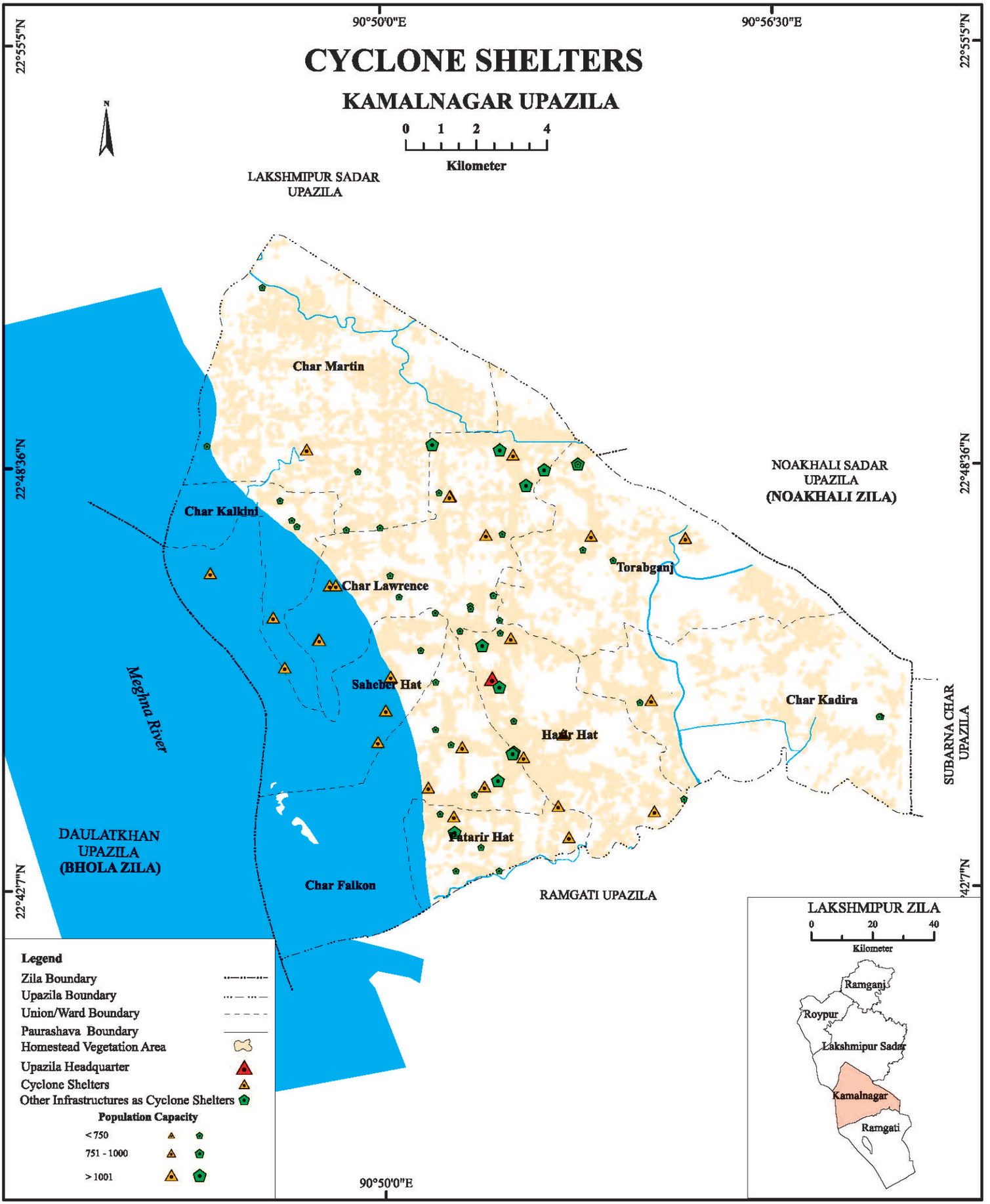
Table 3.9: Upazila specific distribution of cyclone shelters and population.

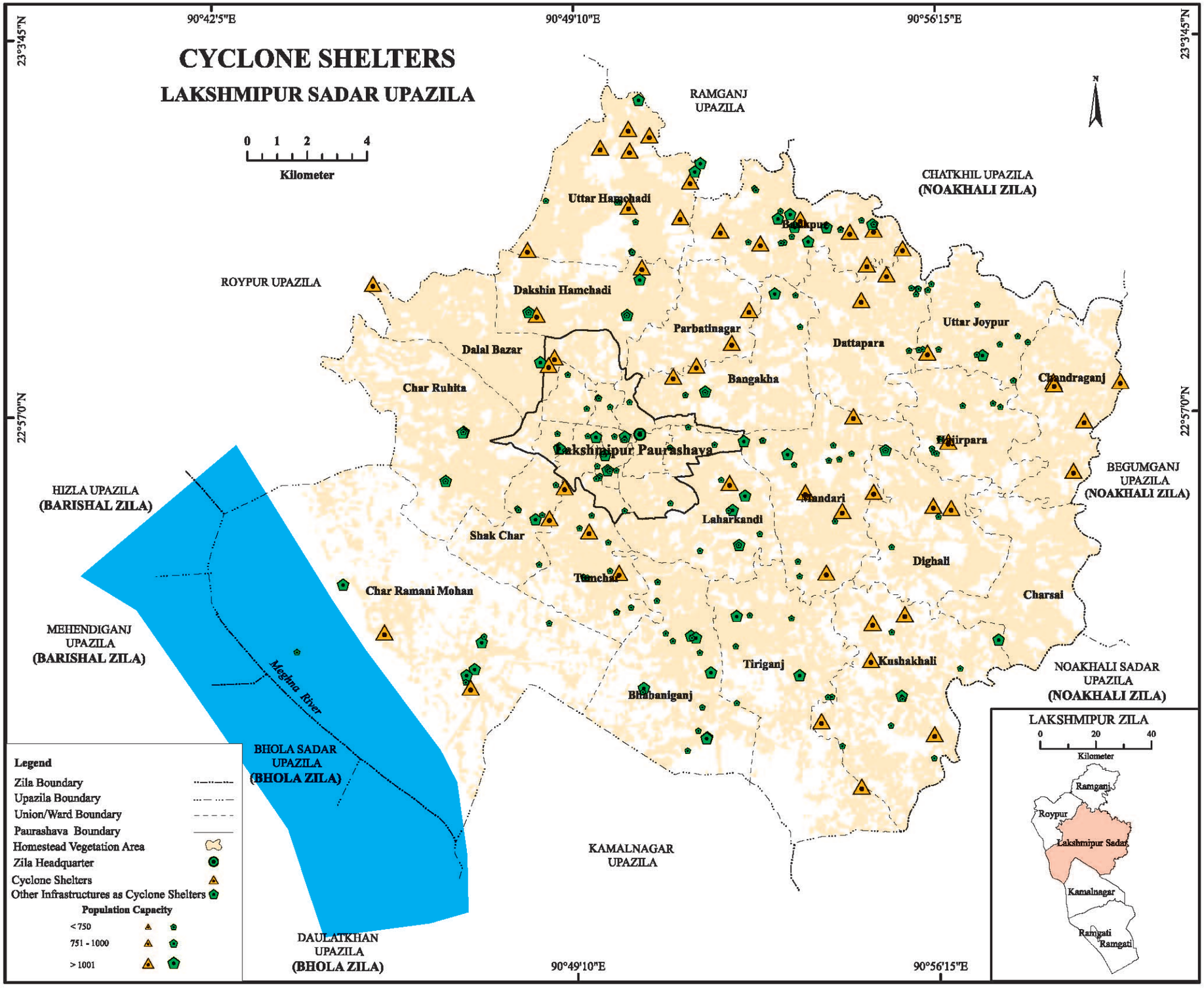
Row Labels	Number of Cyclone Shelter	Capacity	Number of Other Infrastructure as Cyclone Shelter	Other Infrastructure as Cyclone Shelter capacity	Population
Kamalnagar	43	40700	61	47950	223000
Lakshmipur Sadar	71	68450	212	169400	684000
Ramganj	27	23850	64	54650	286000
Ramgati	10	8925	75	60750	261000
Roypur	91	82450	38	31150	275000
Total	**242**	**2,24,375**	**450**	**3,63,900**	**17,29,000**

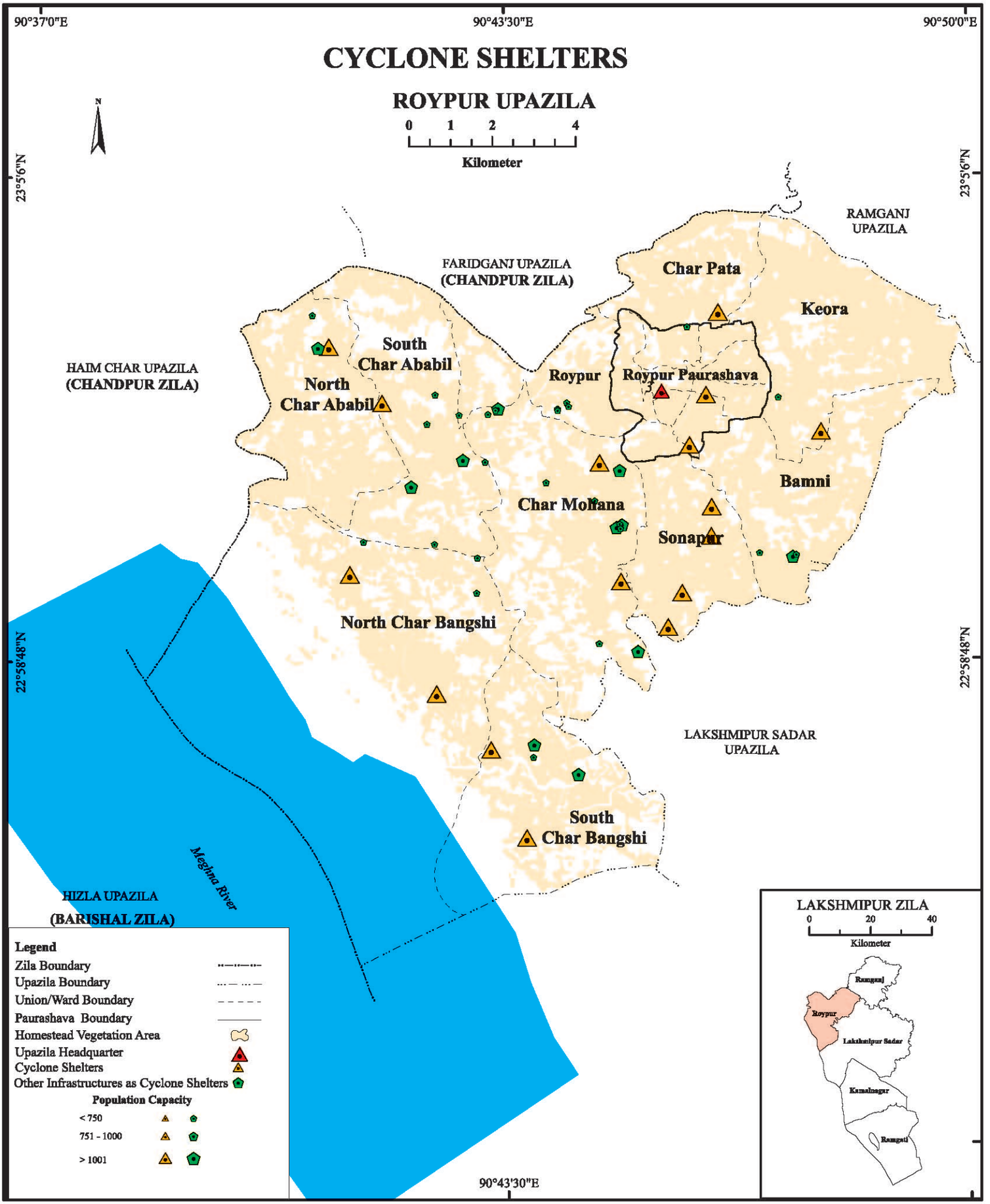
Source: BMD, BBS field survey 2019

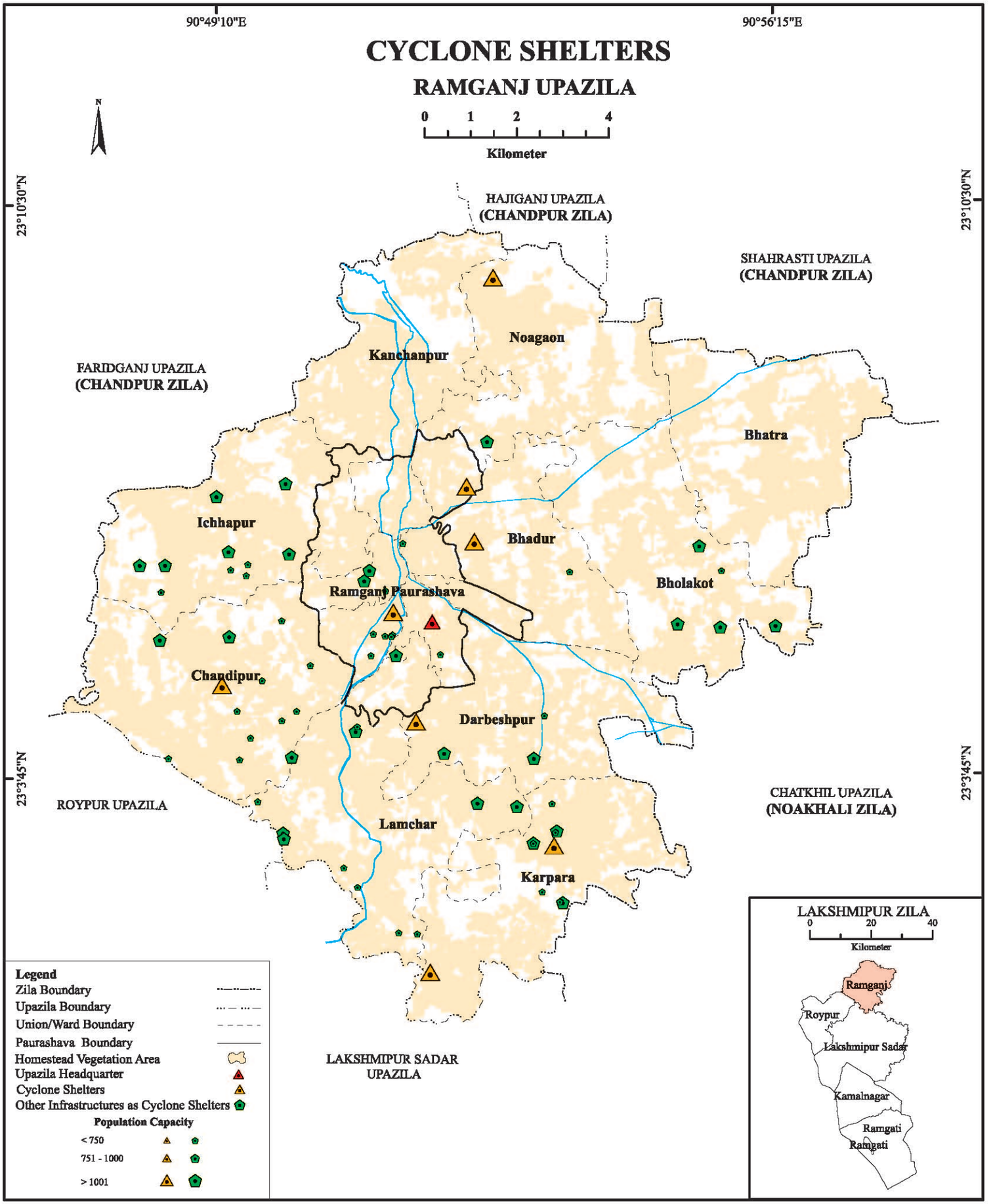
Cyclone Shelters
Area Map

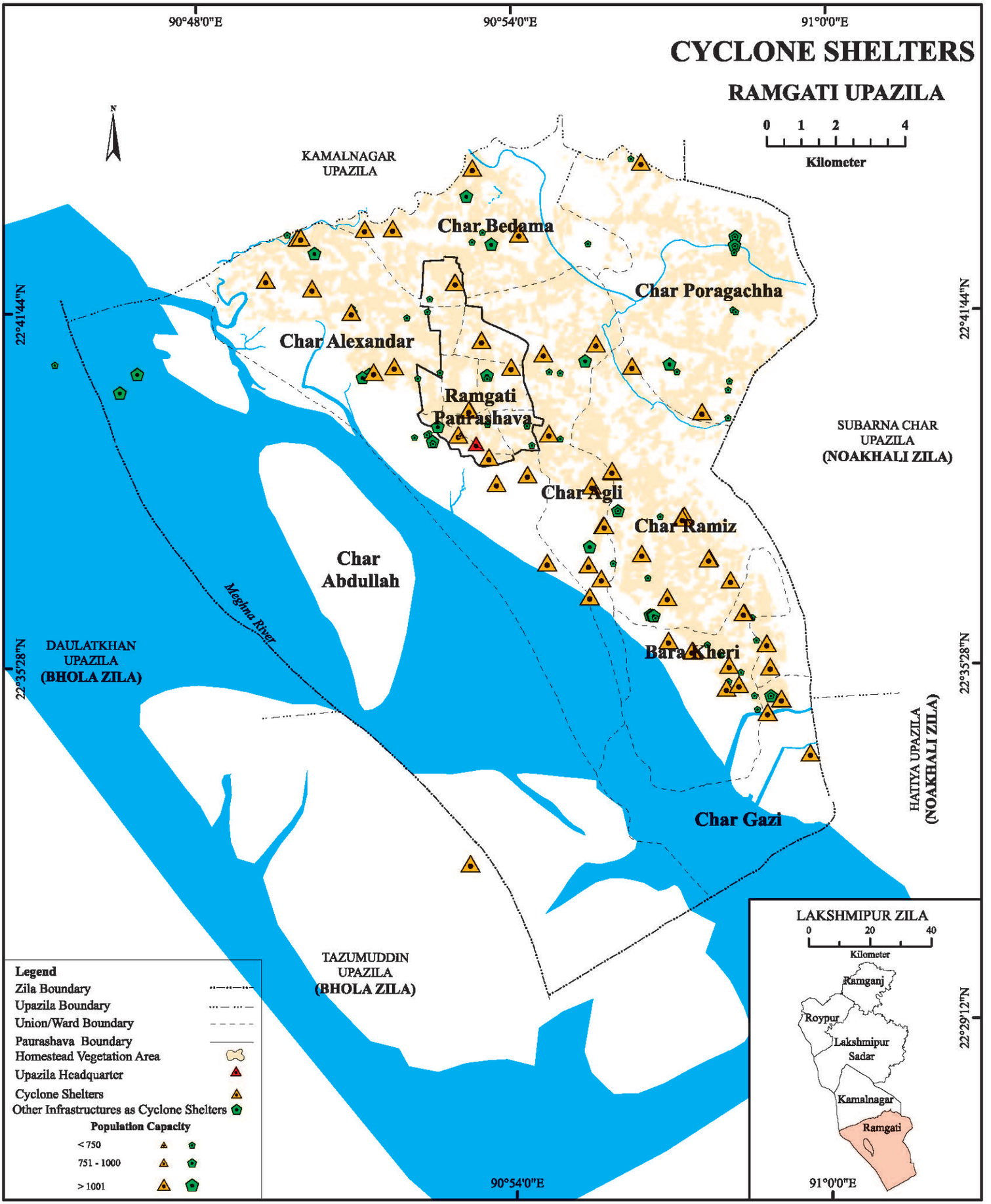








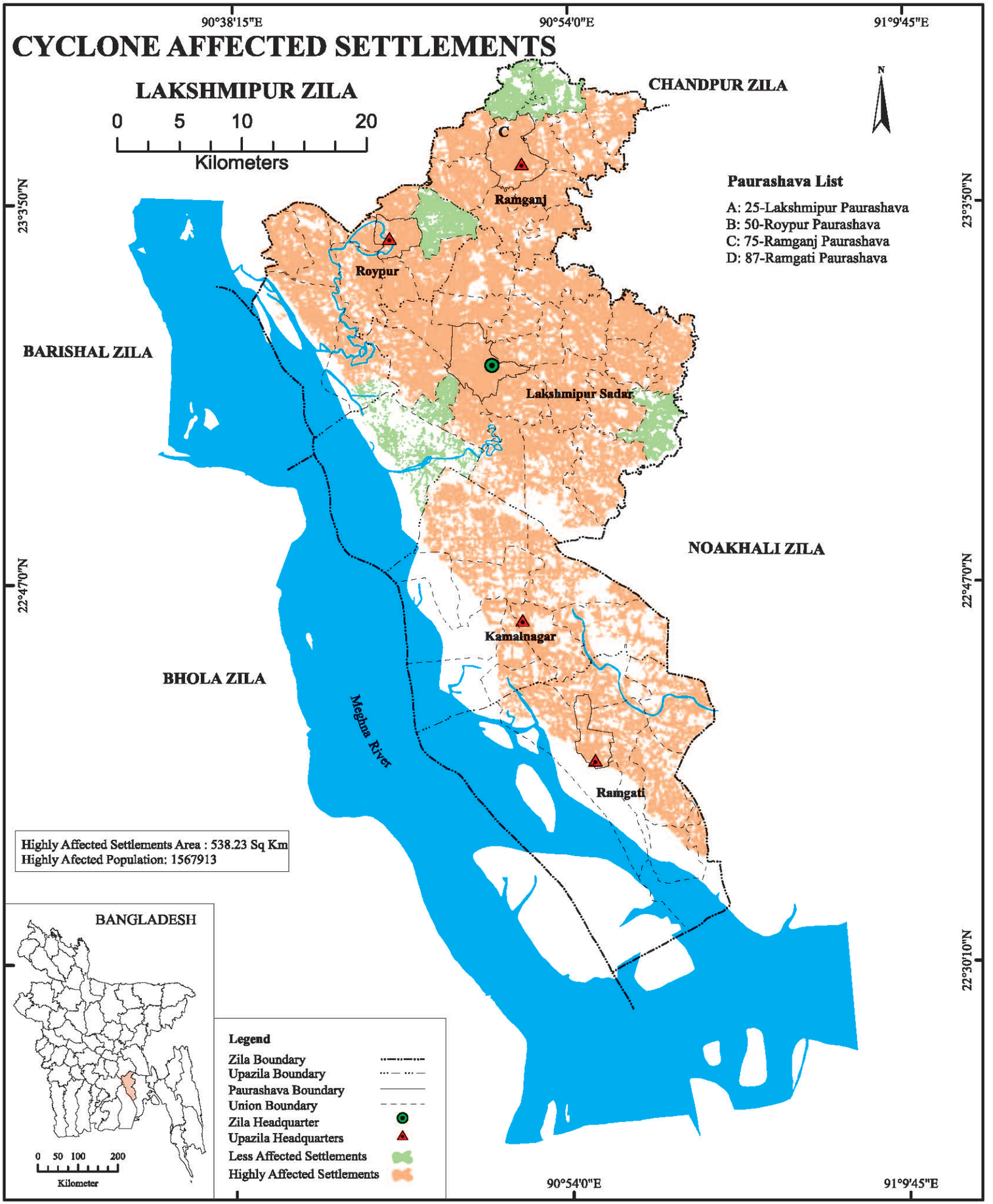


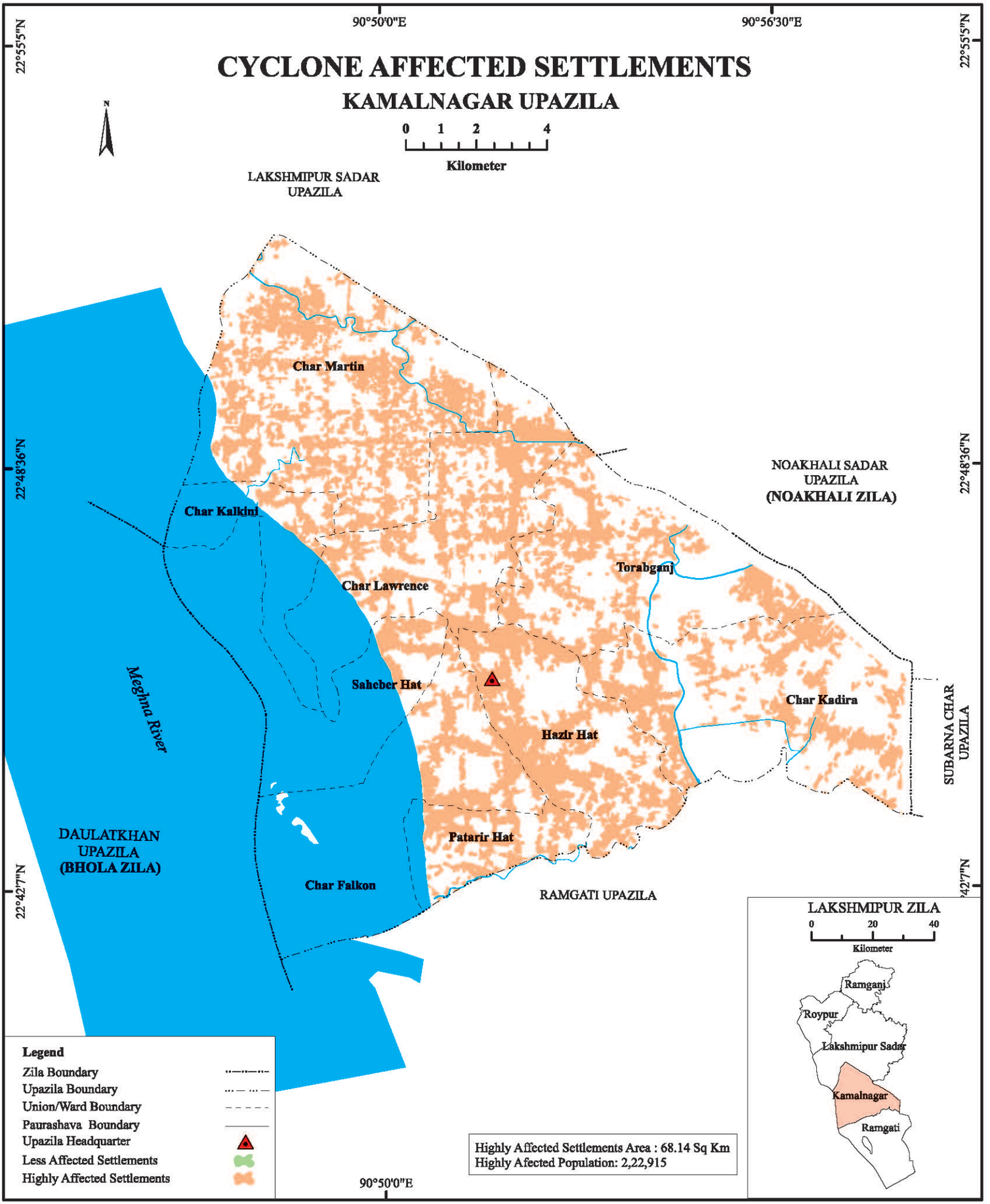


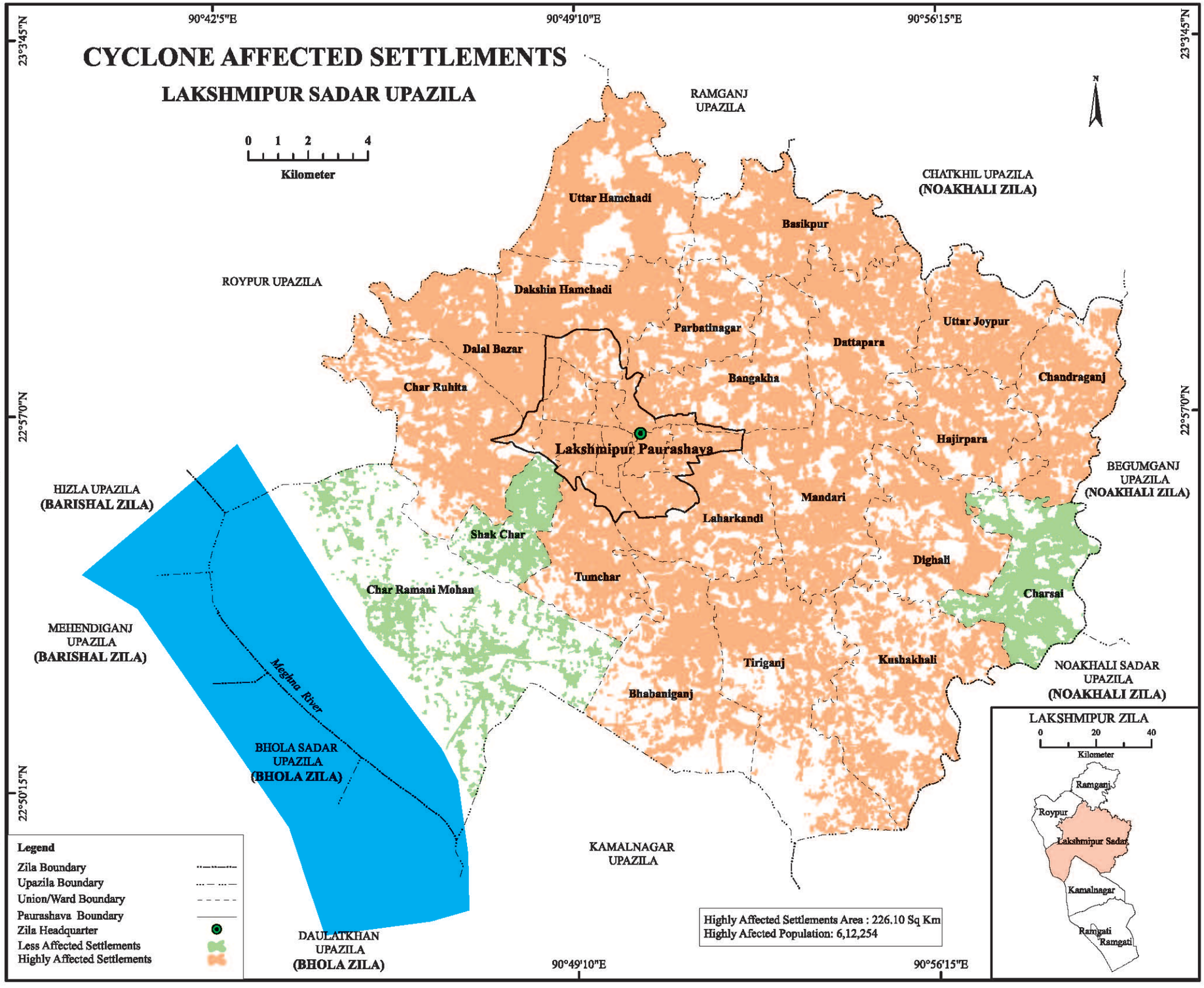
Chapter 4

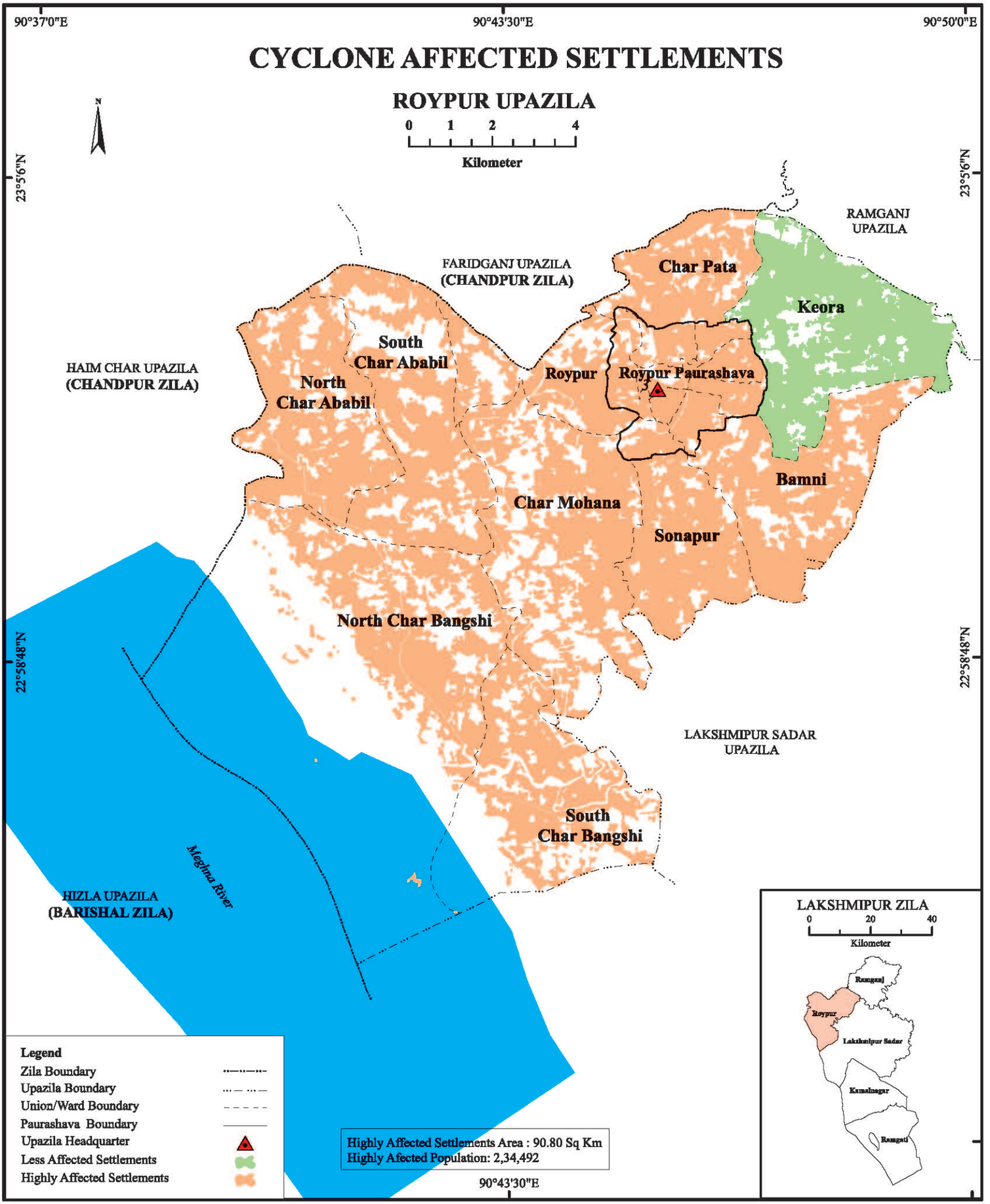
Hazard Assessment and Mapping

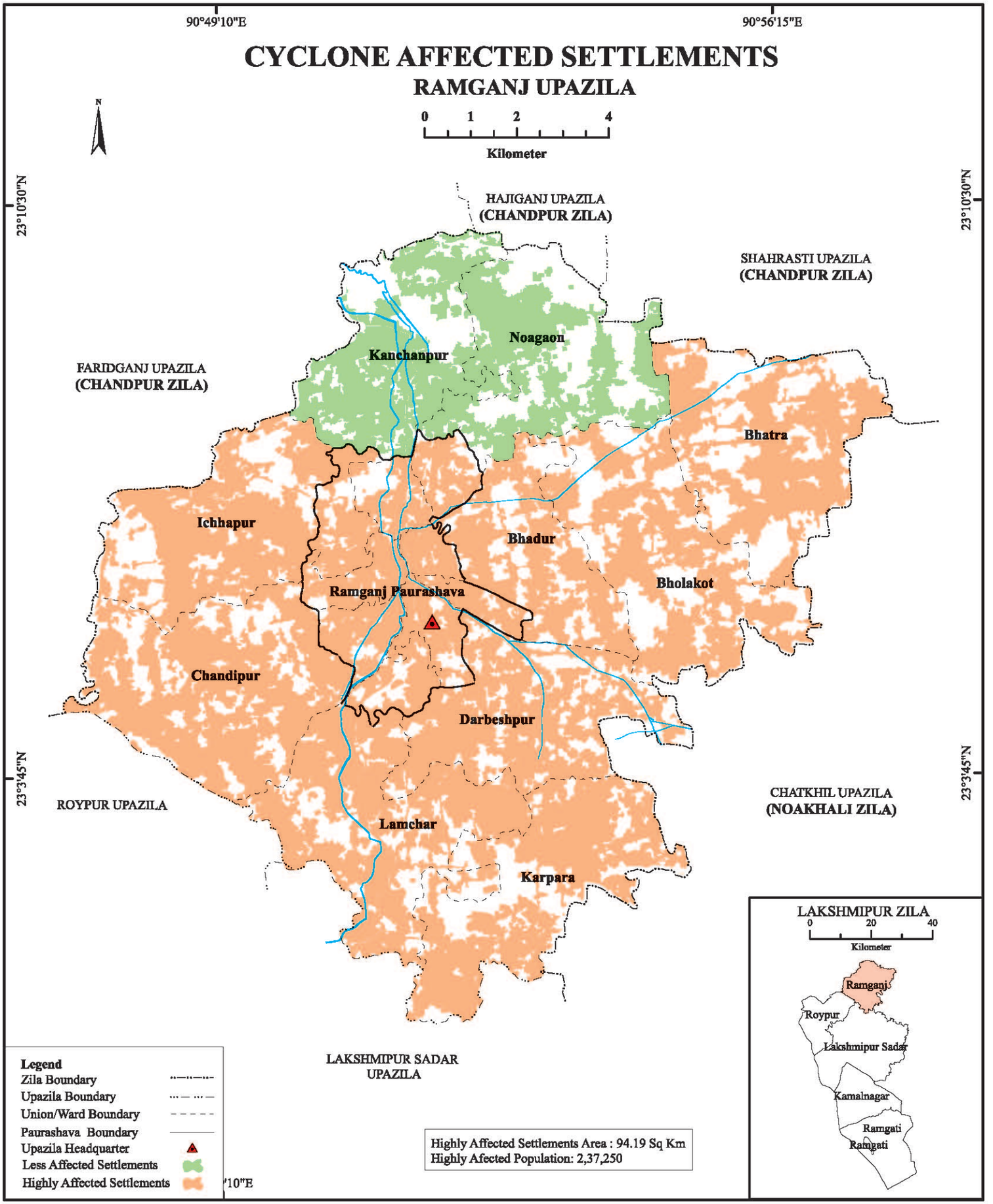
Cyclone Affected Area Map

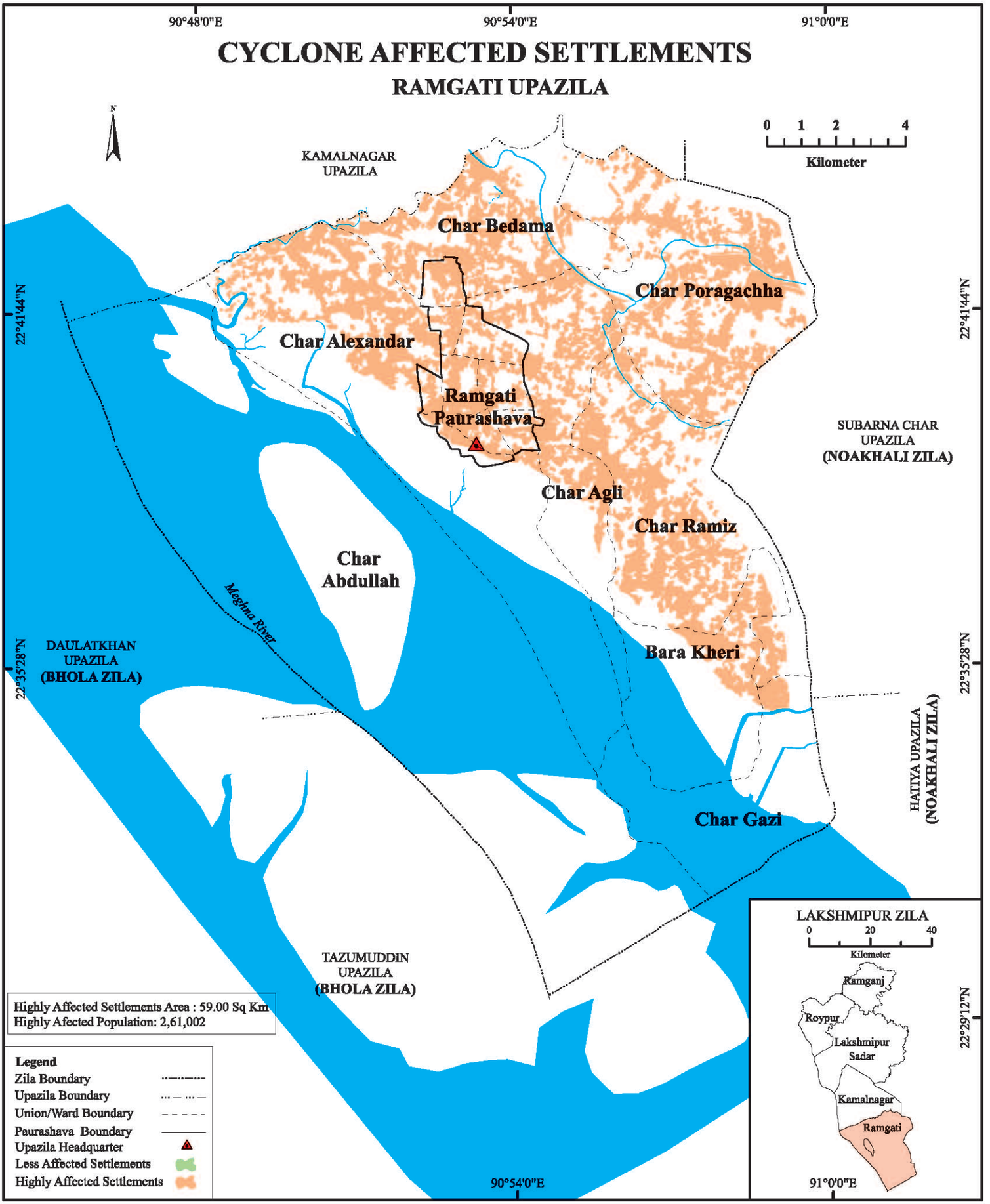




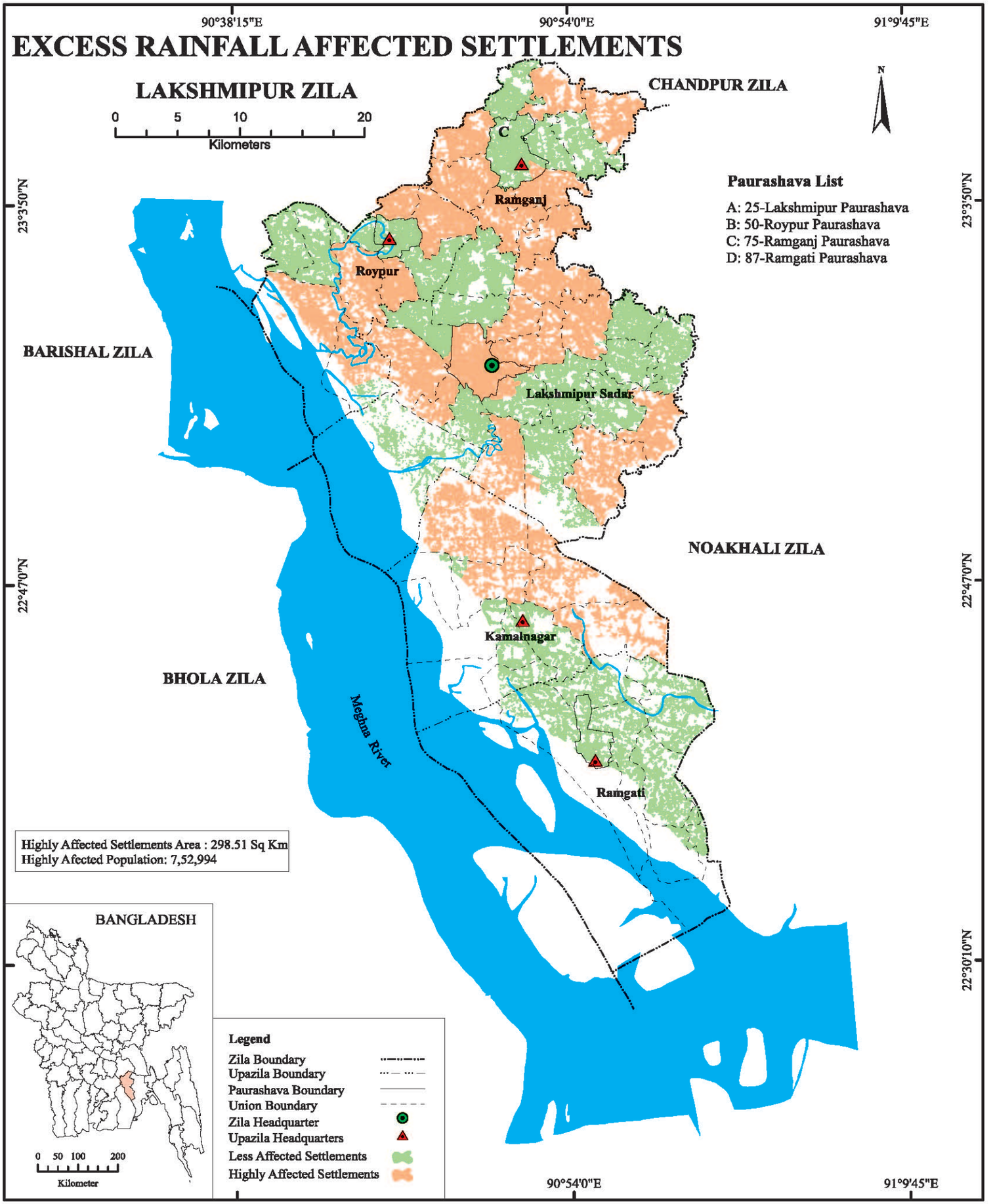


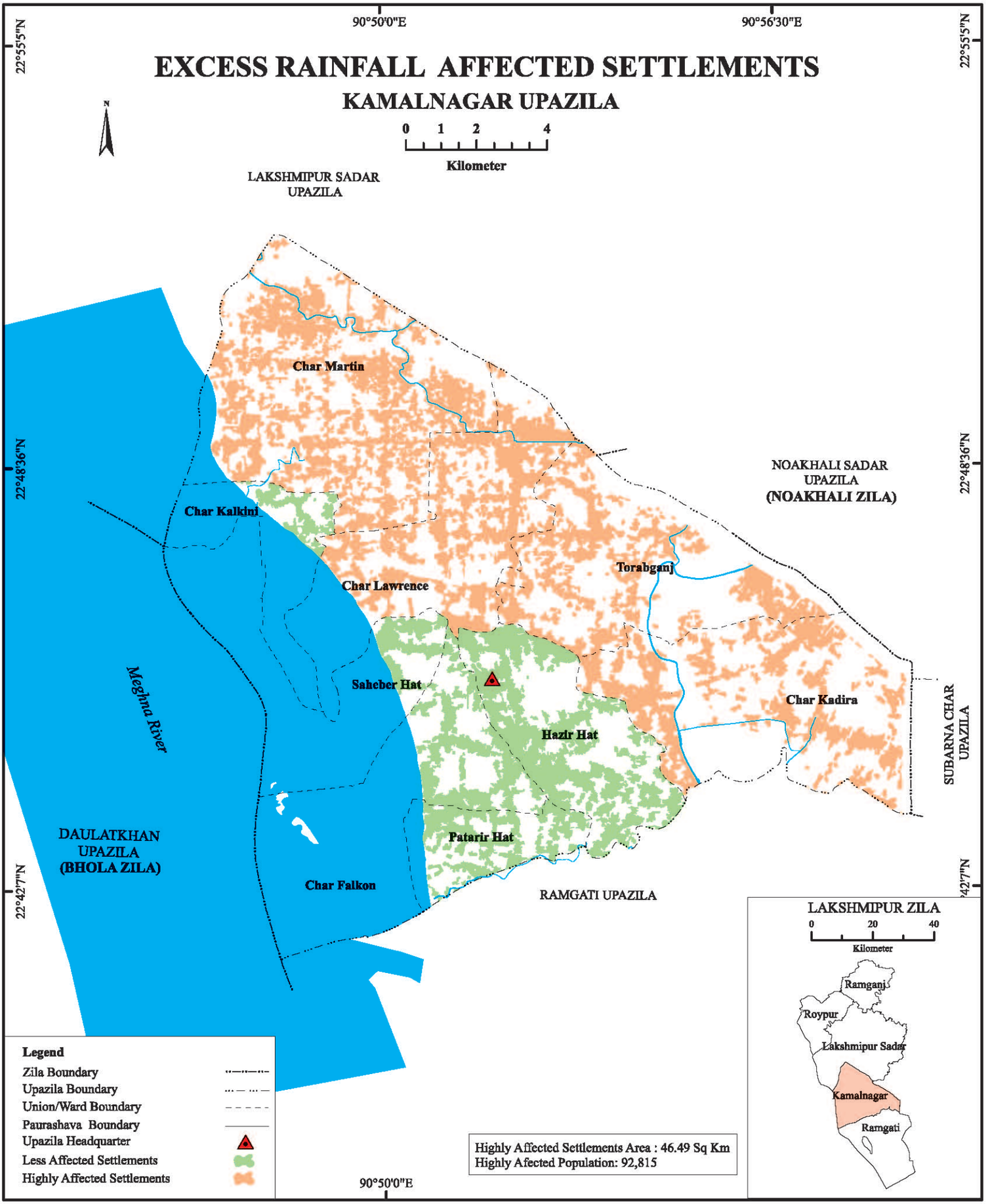






Excess Rainfall Affected Area Map





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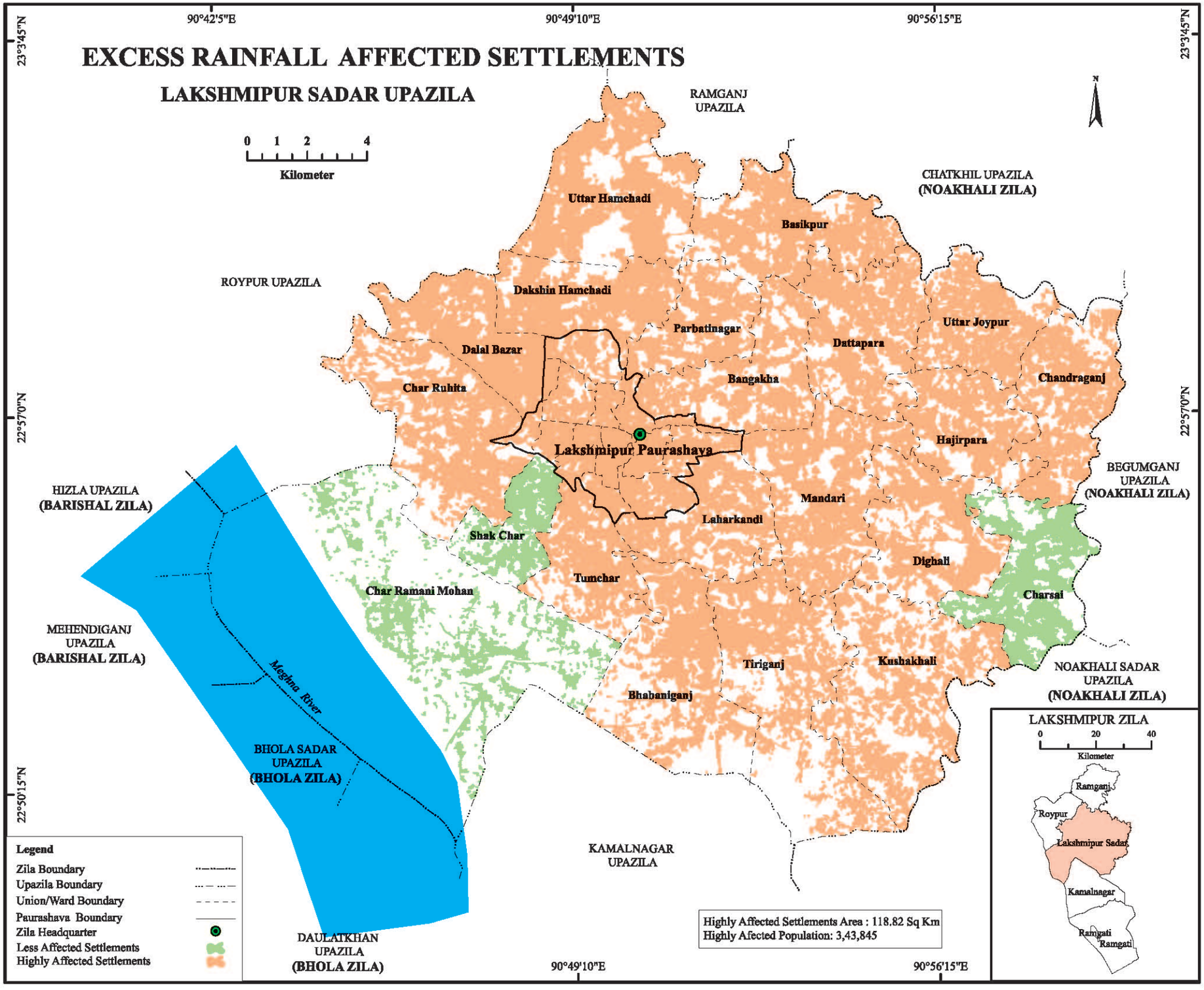

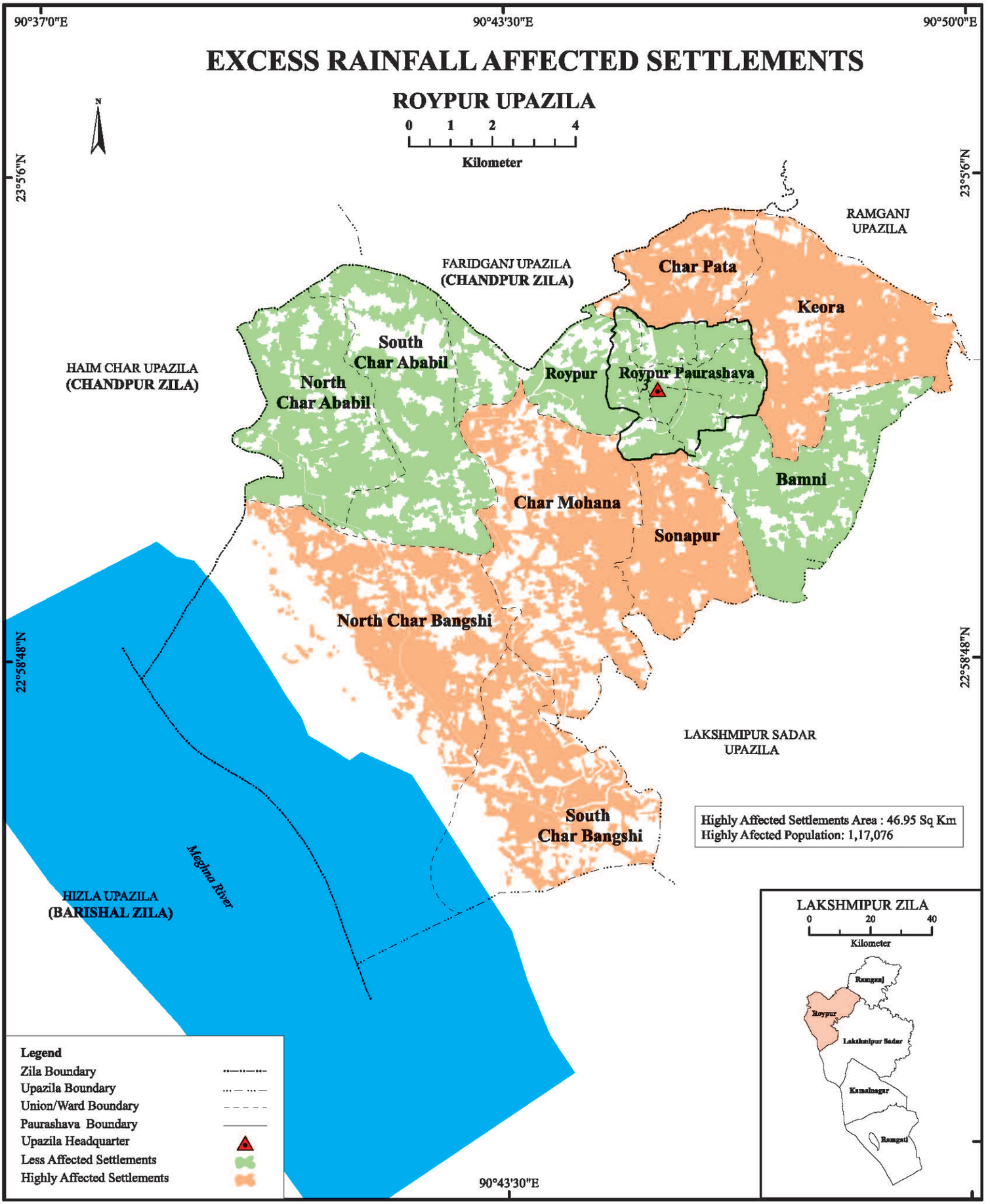

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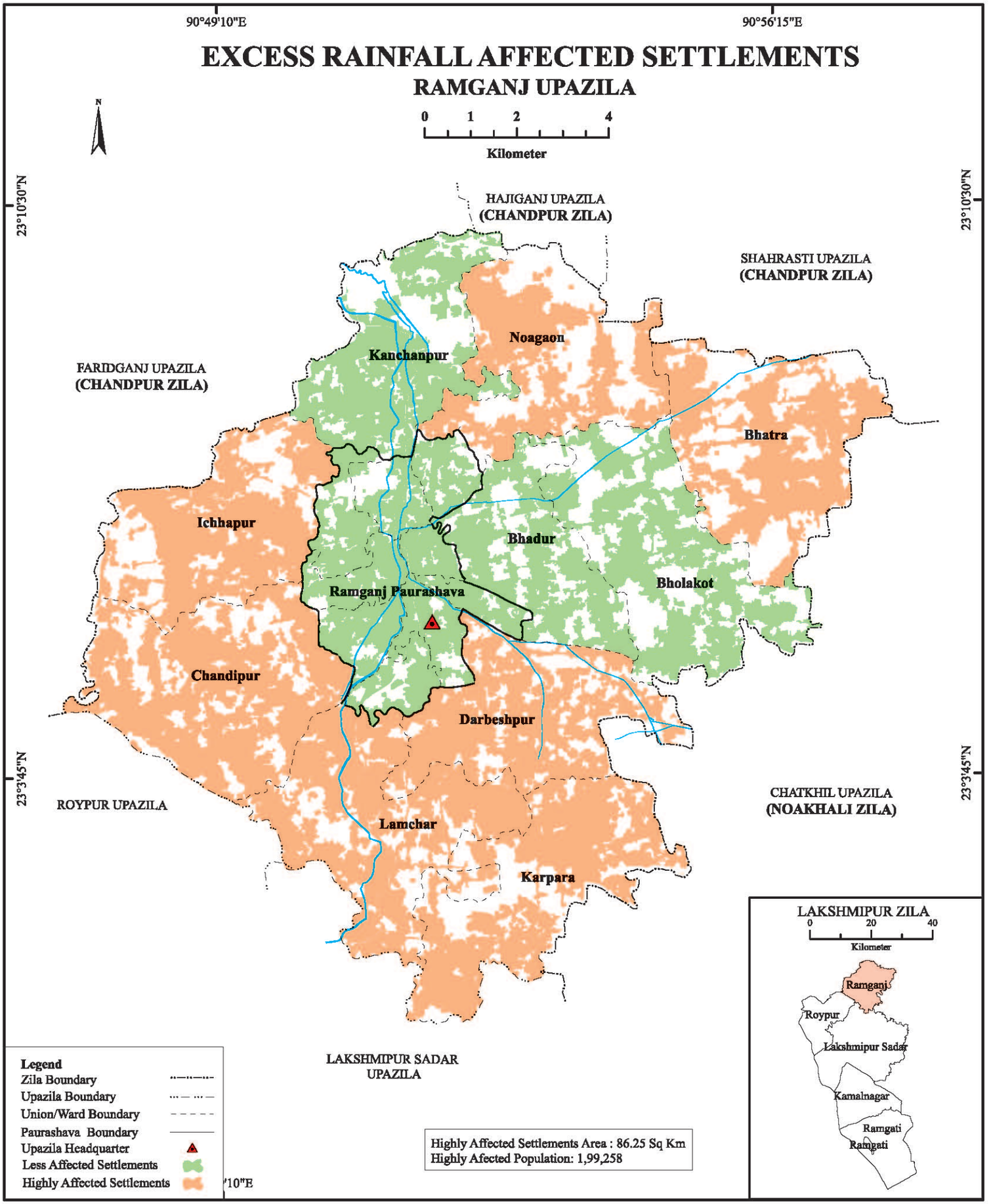
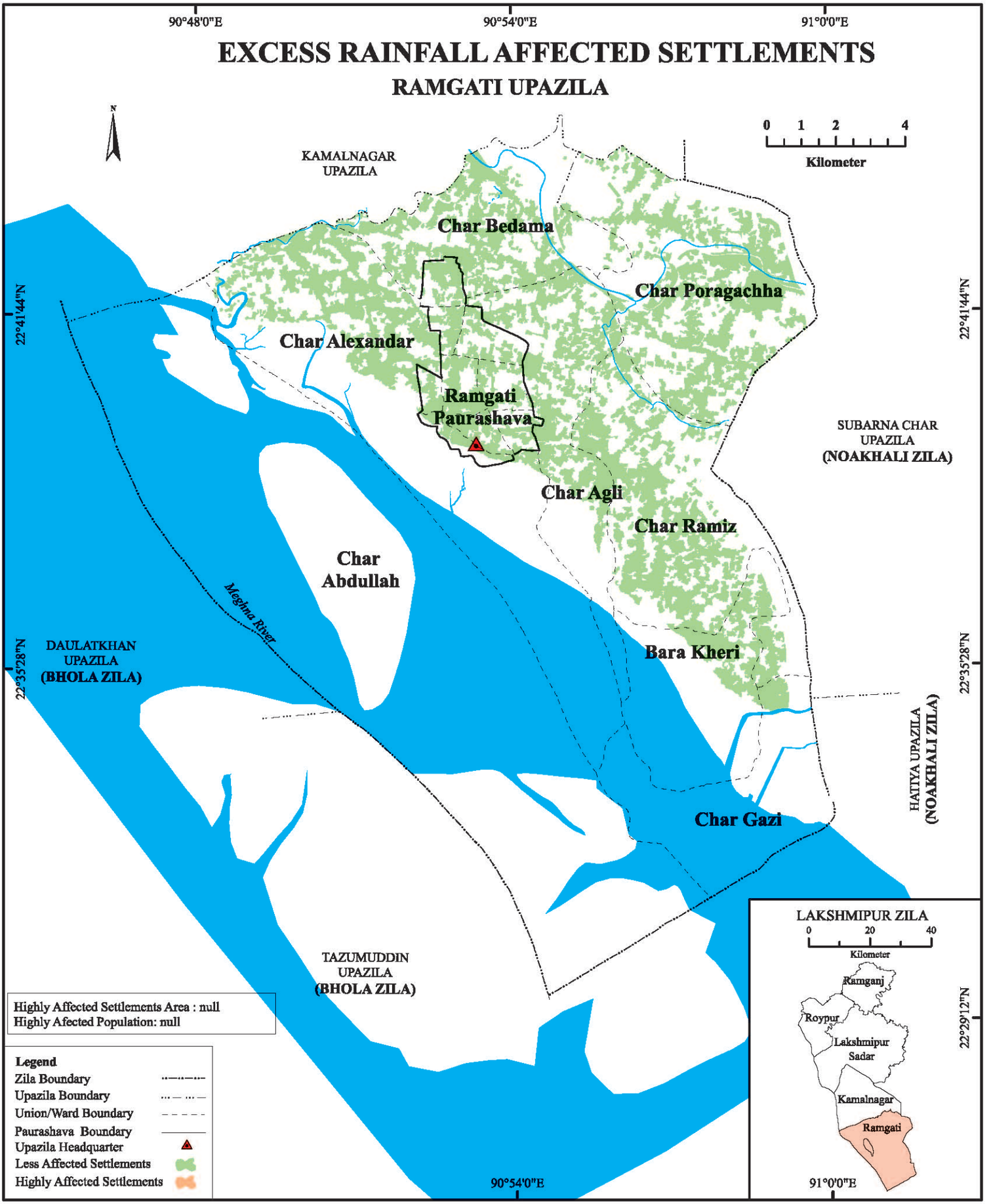
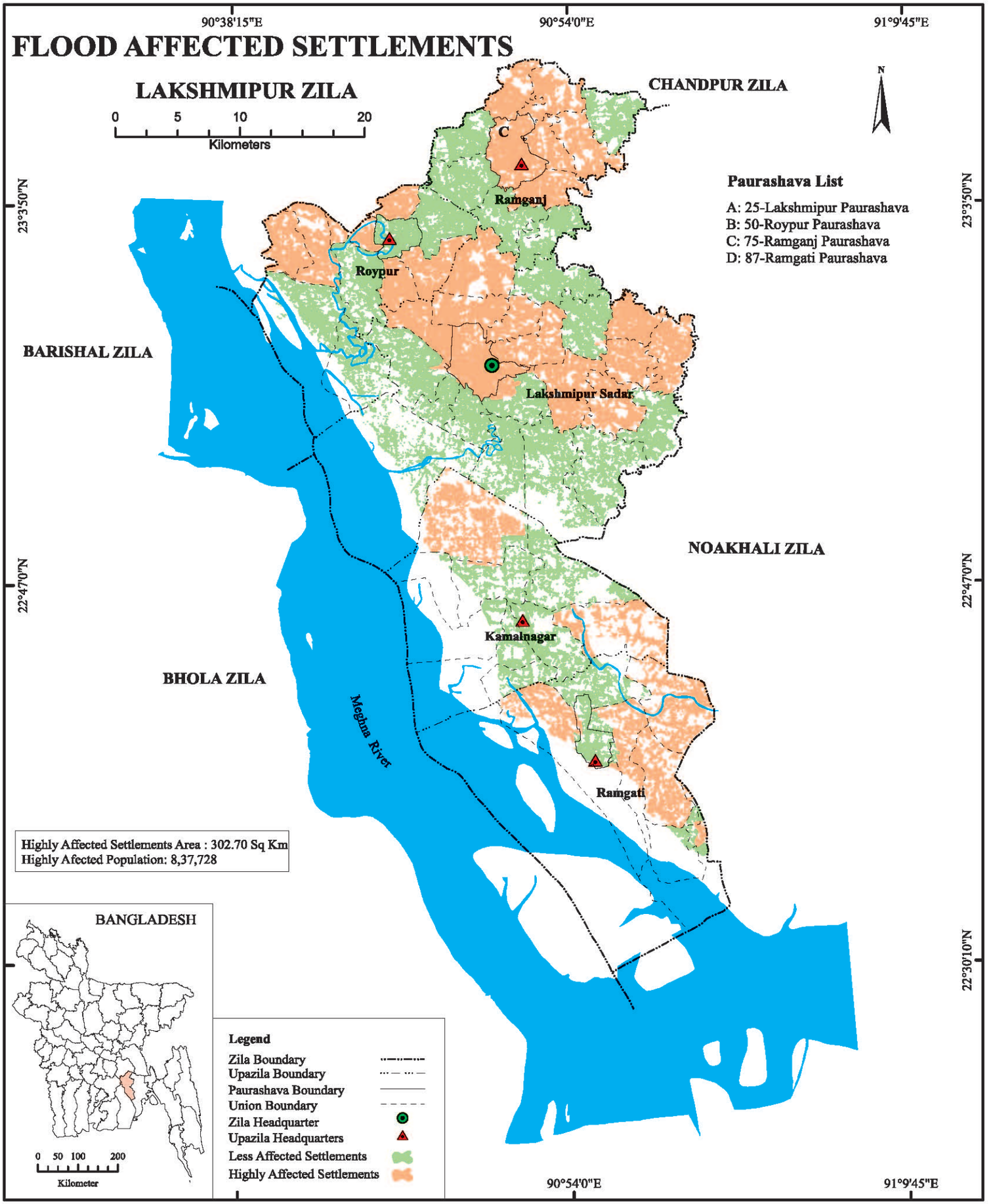
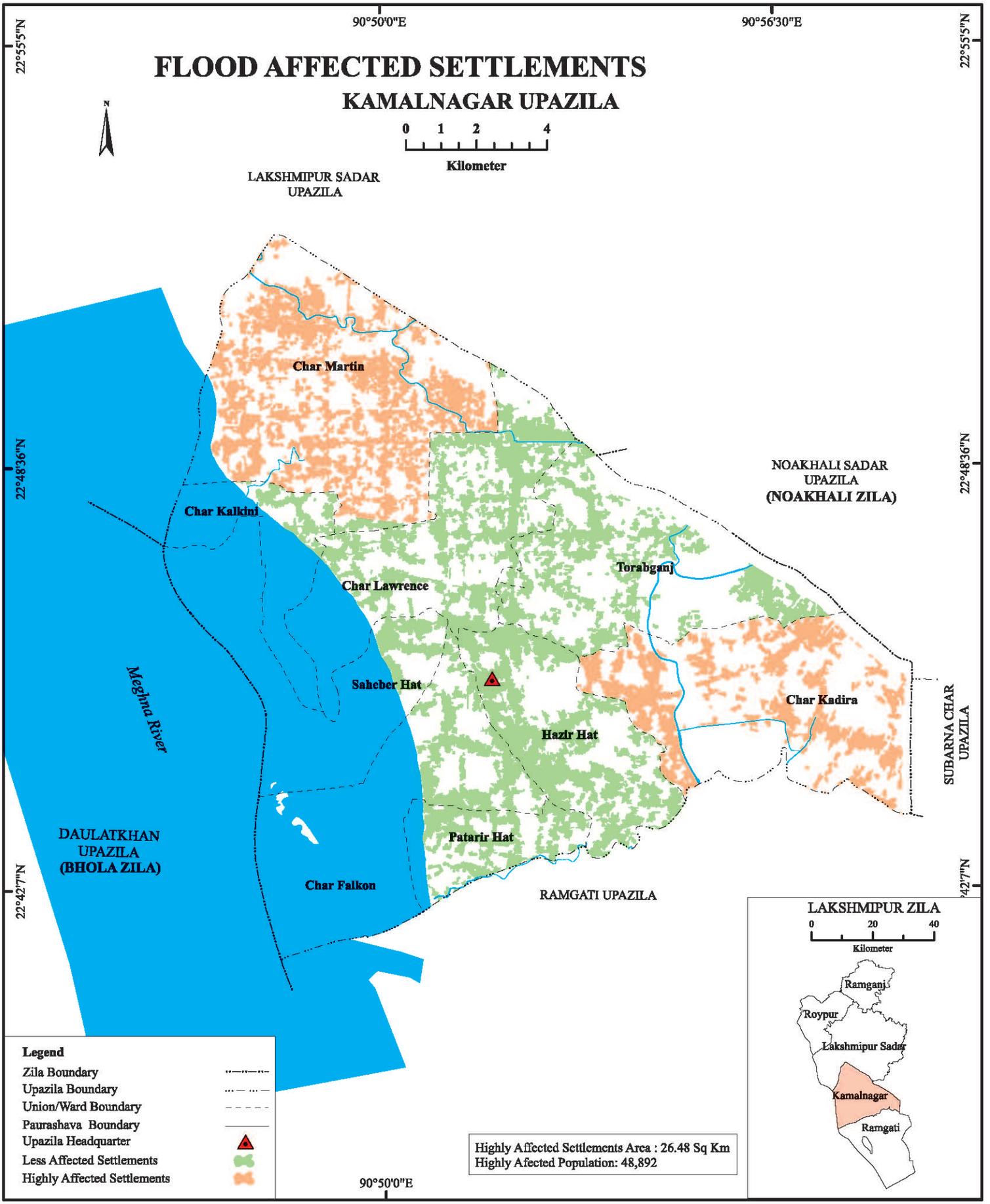




Flood Affected
Area Map





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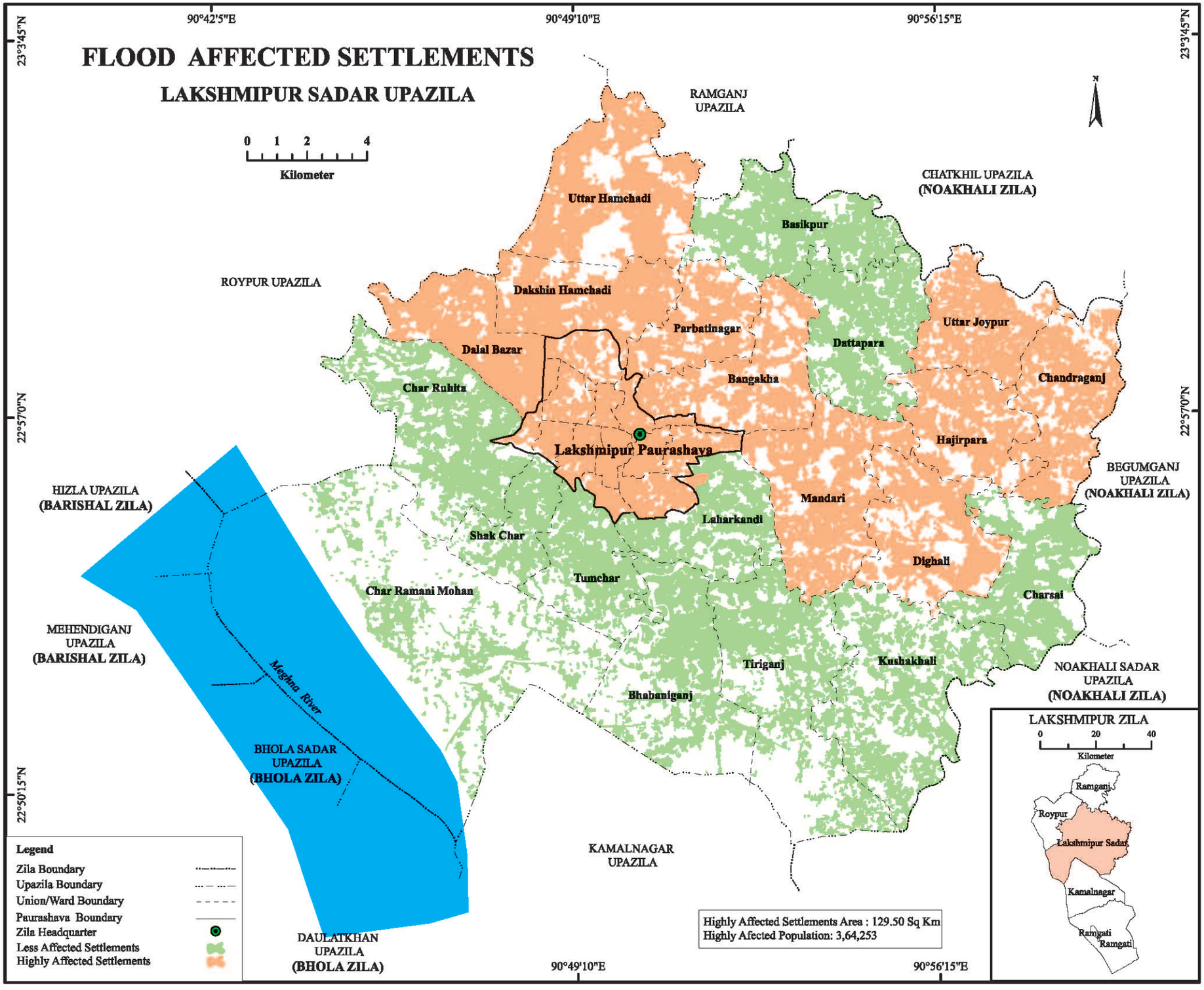

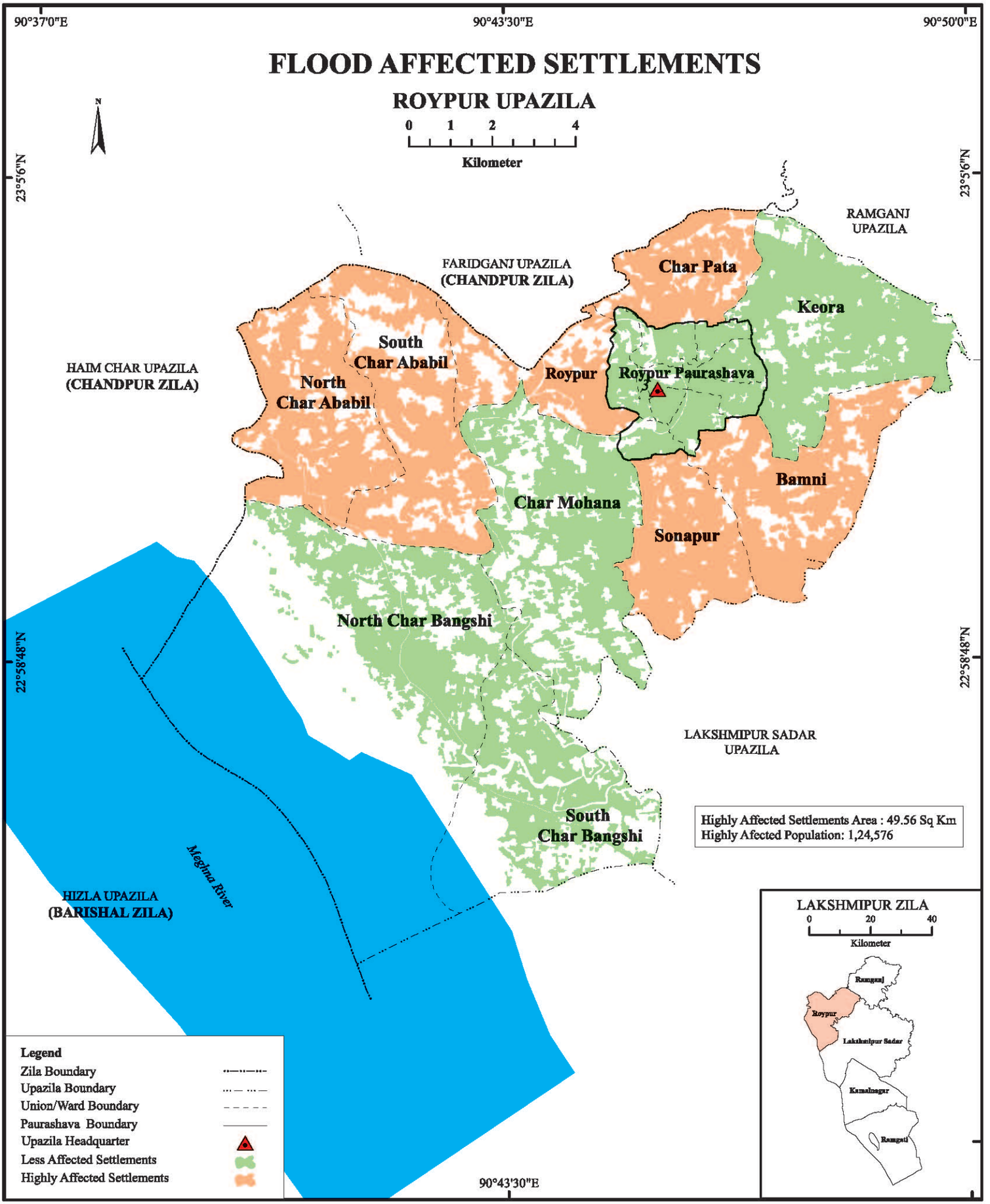

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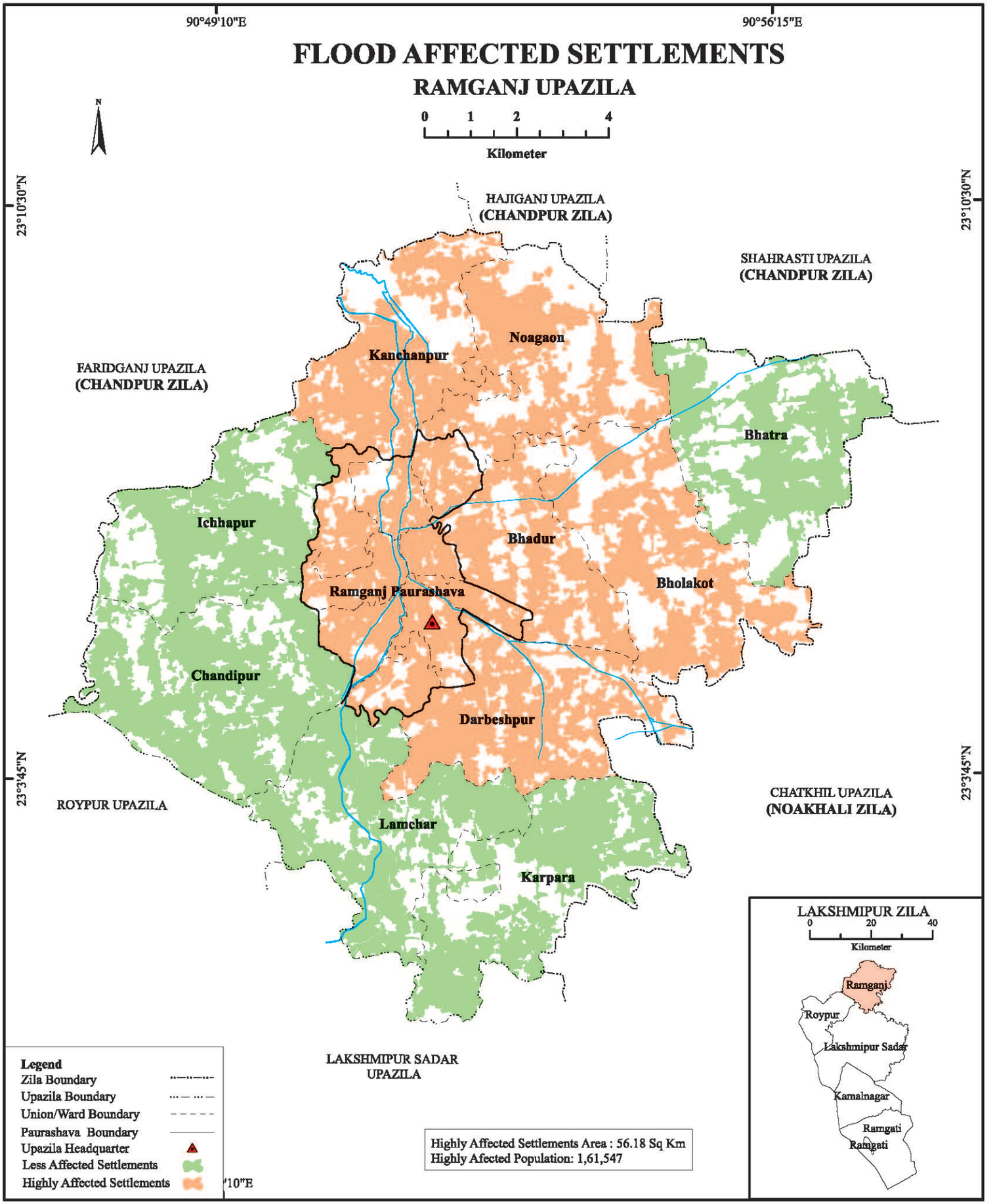
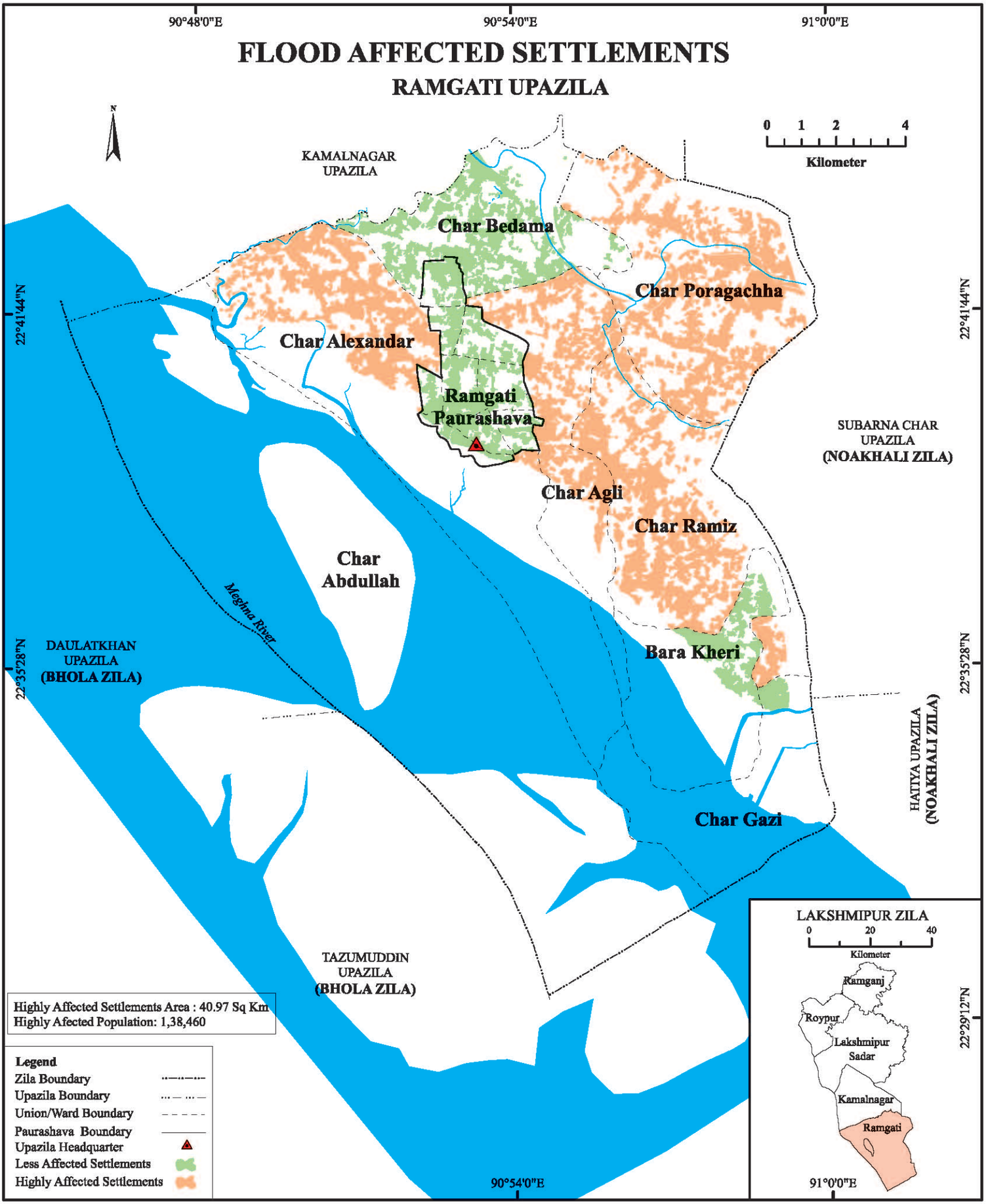
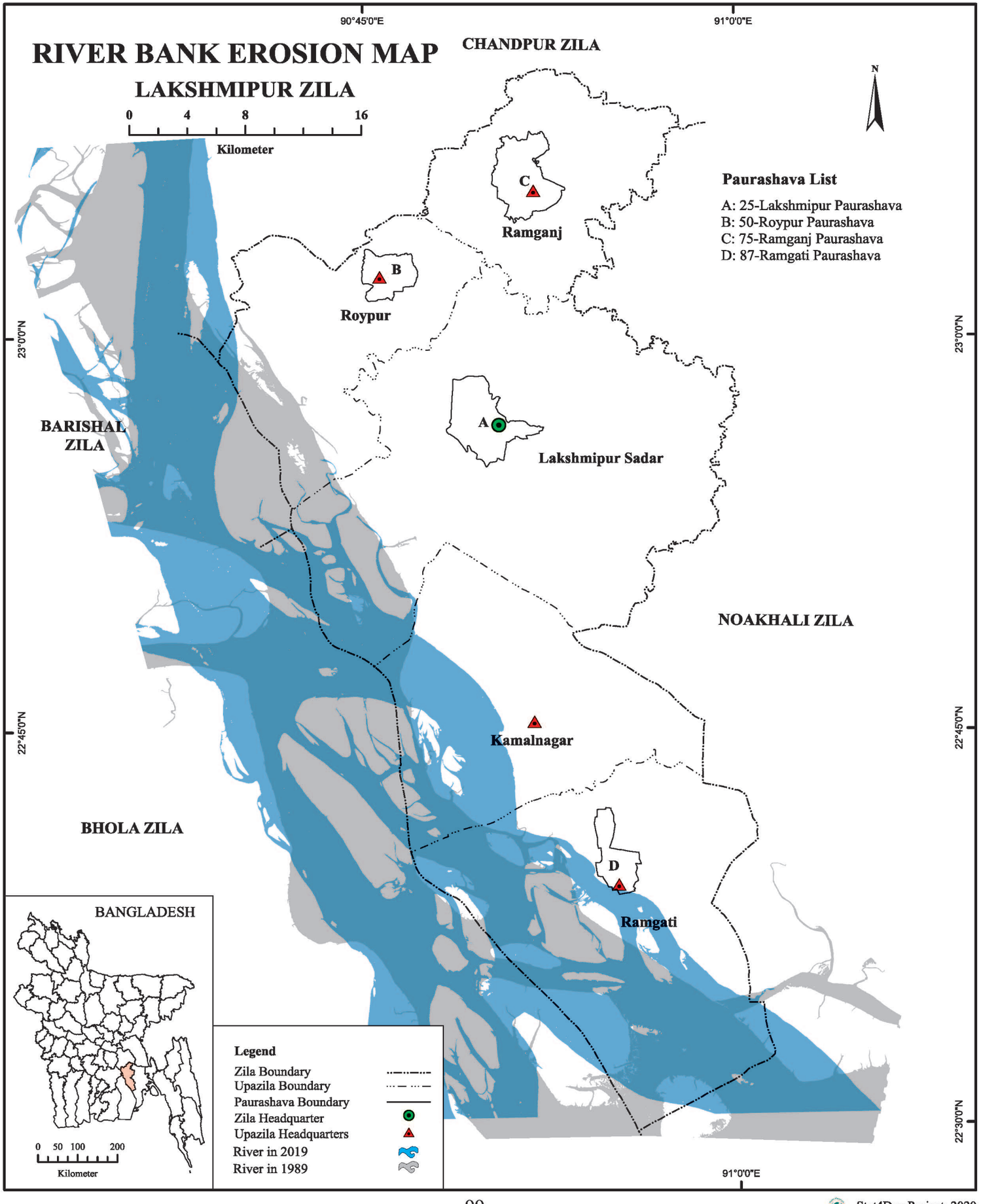
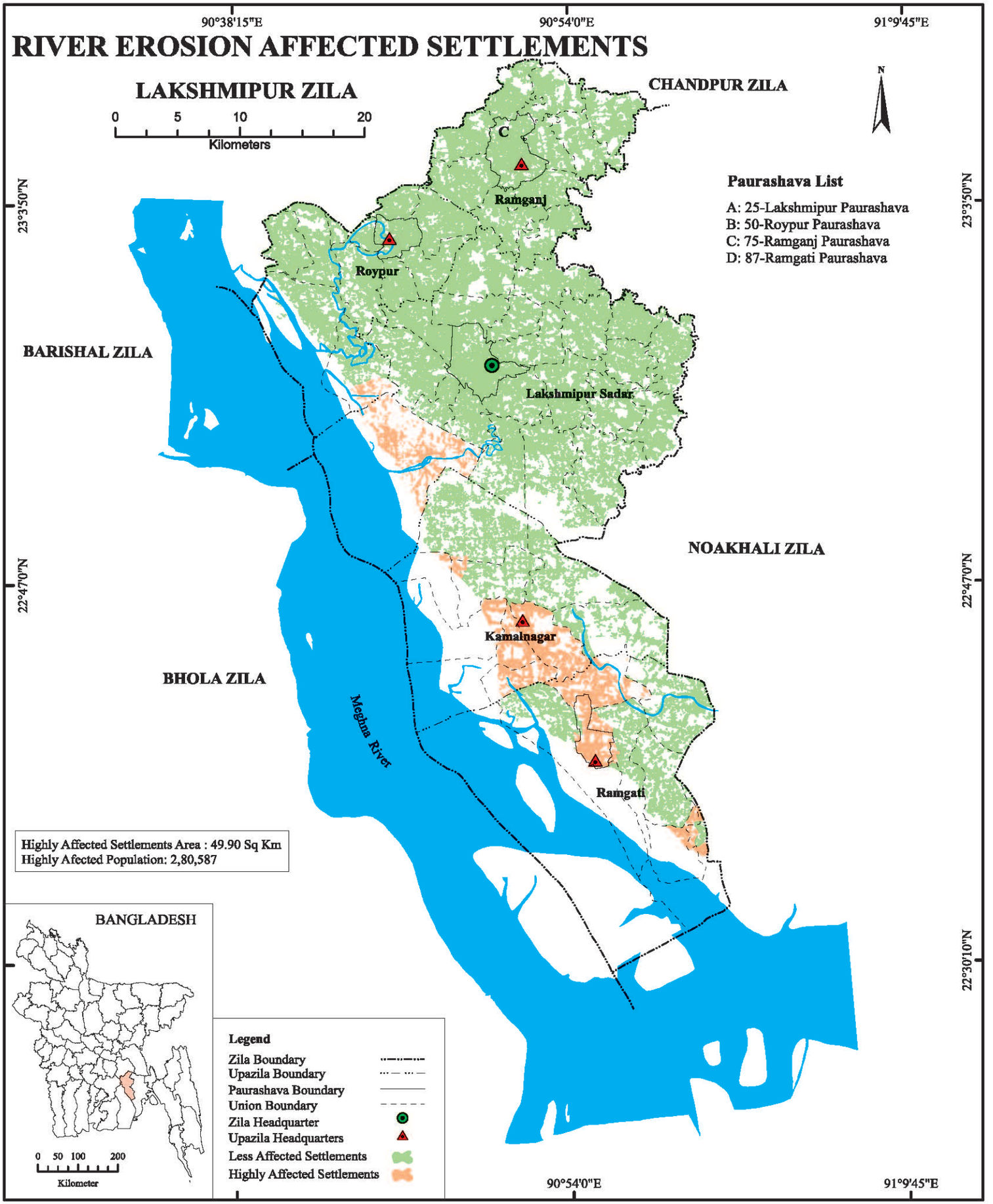
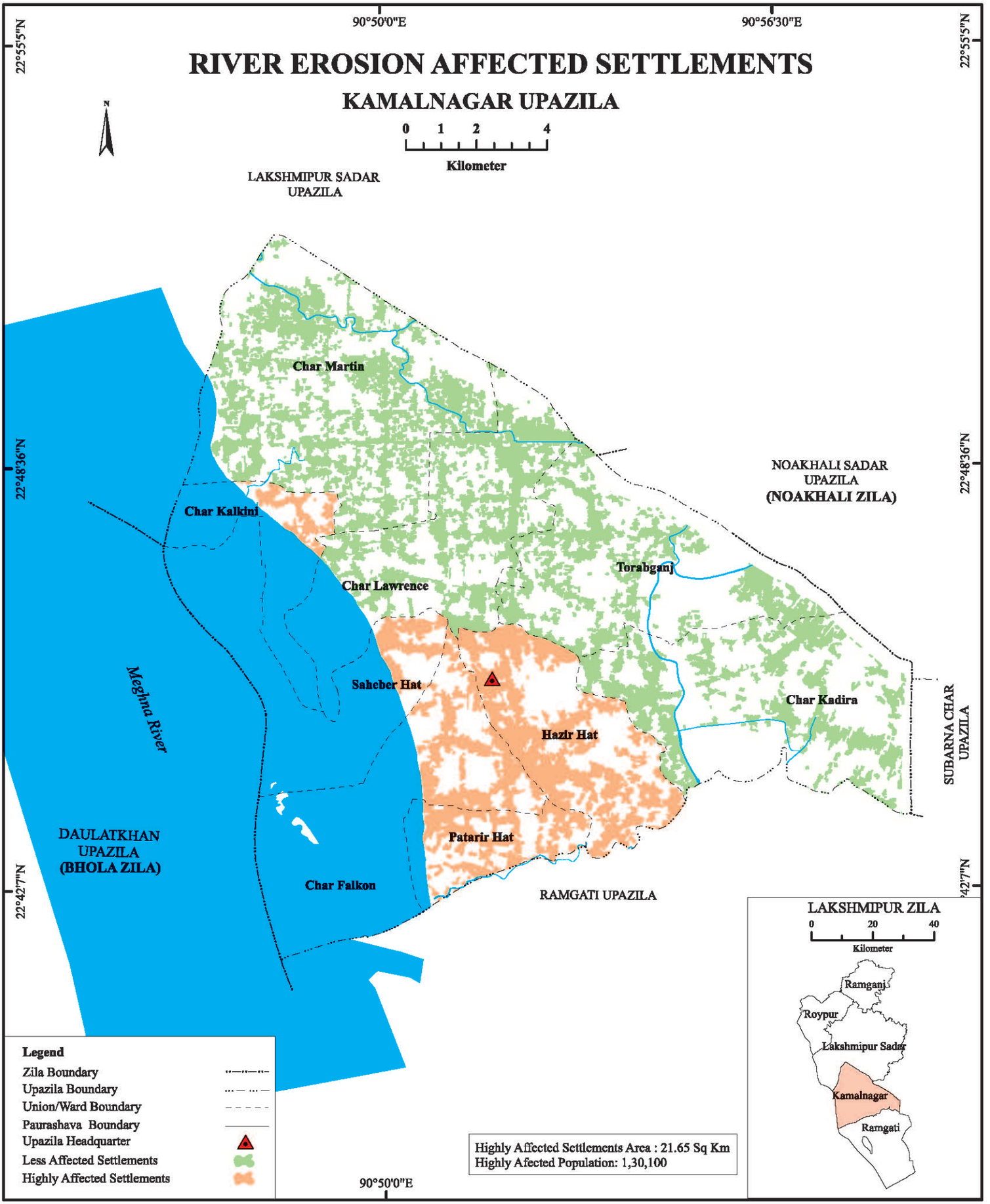


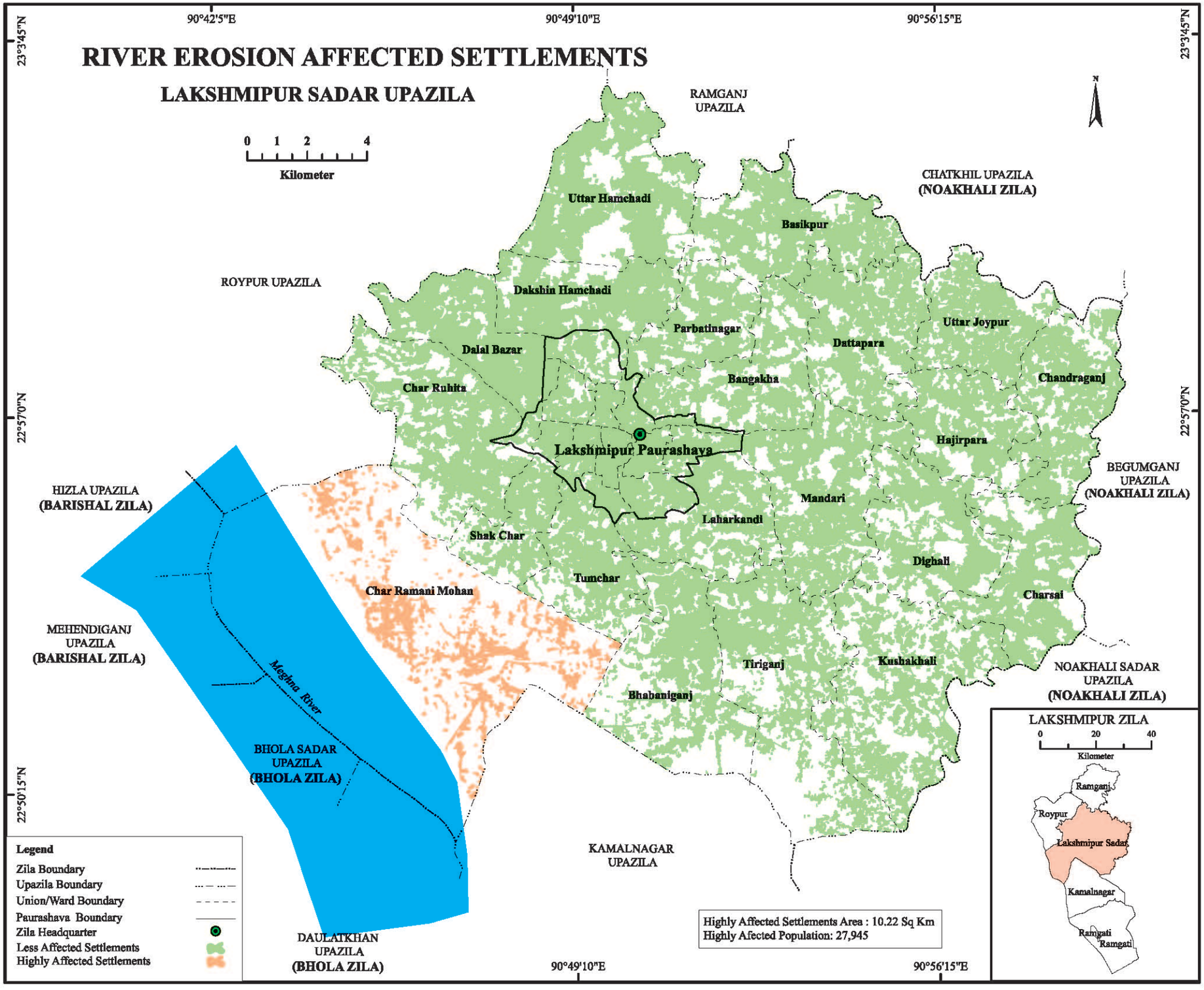


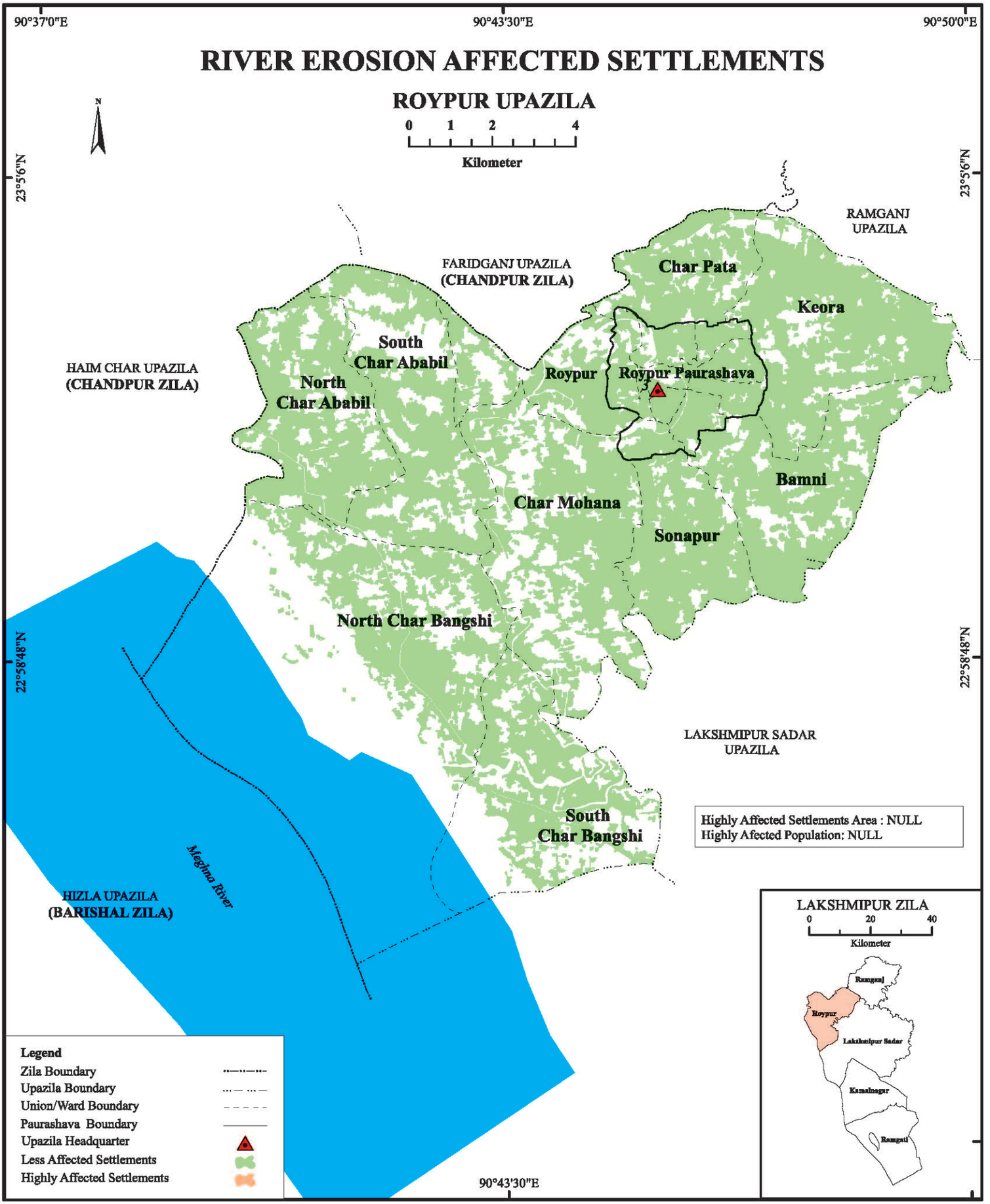
River Erosion Affected Area Map

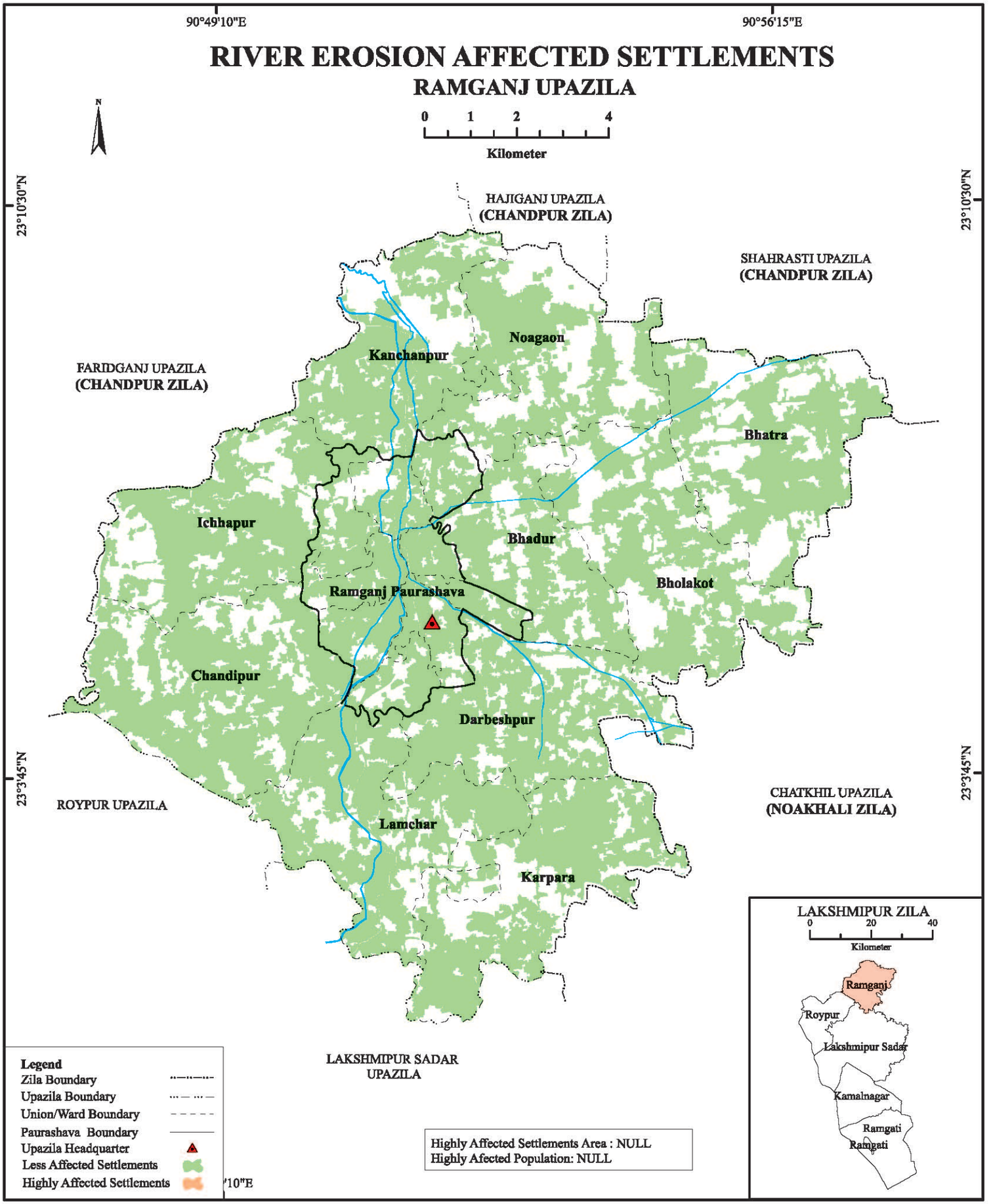


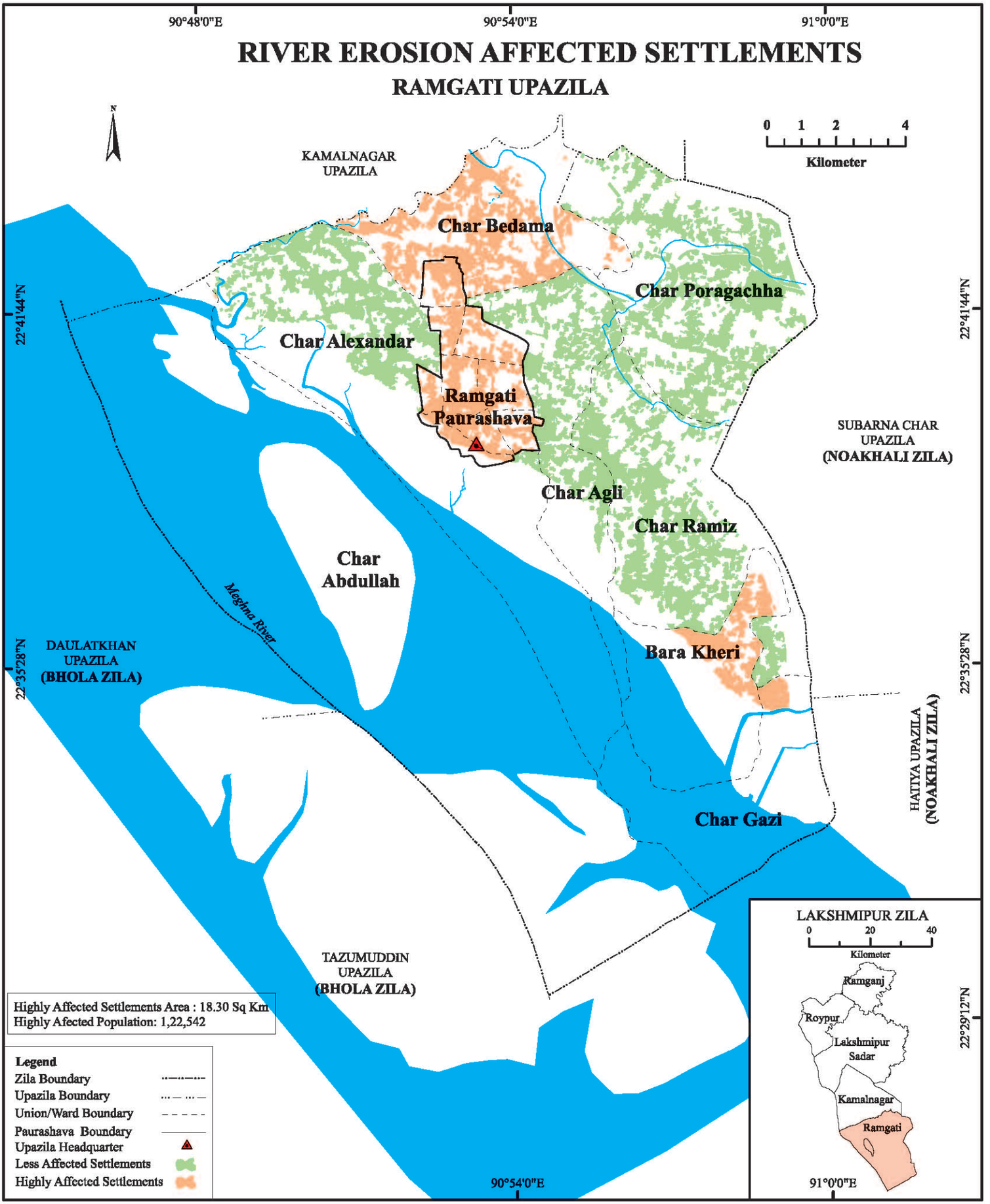




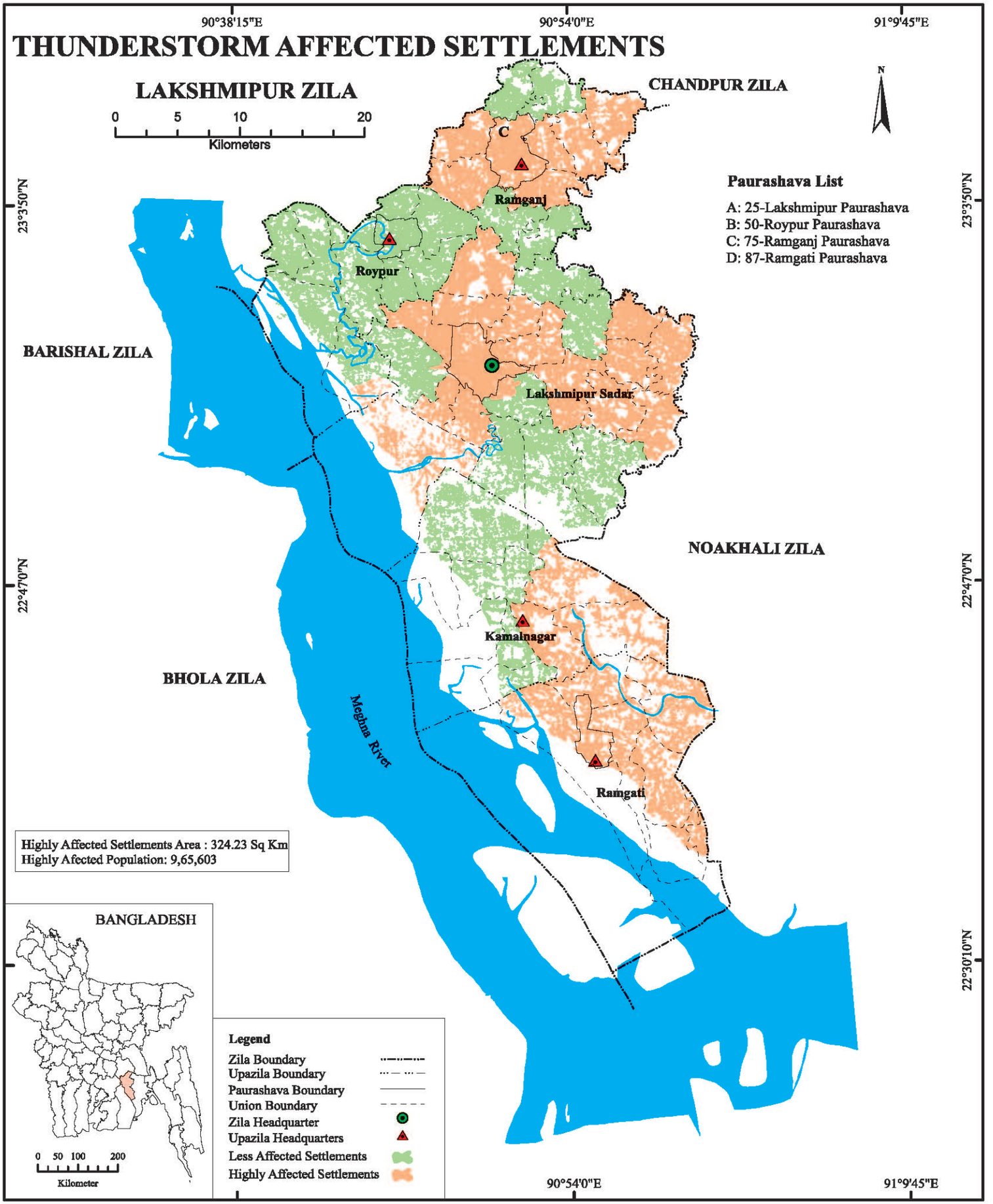


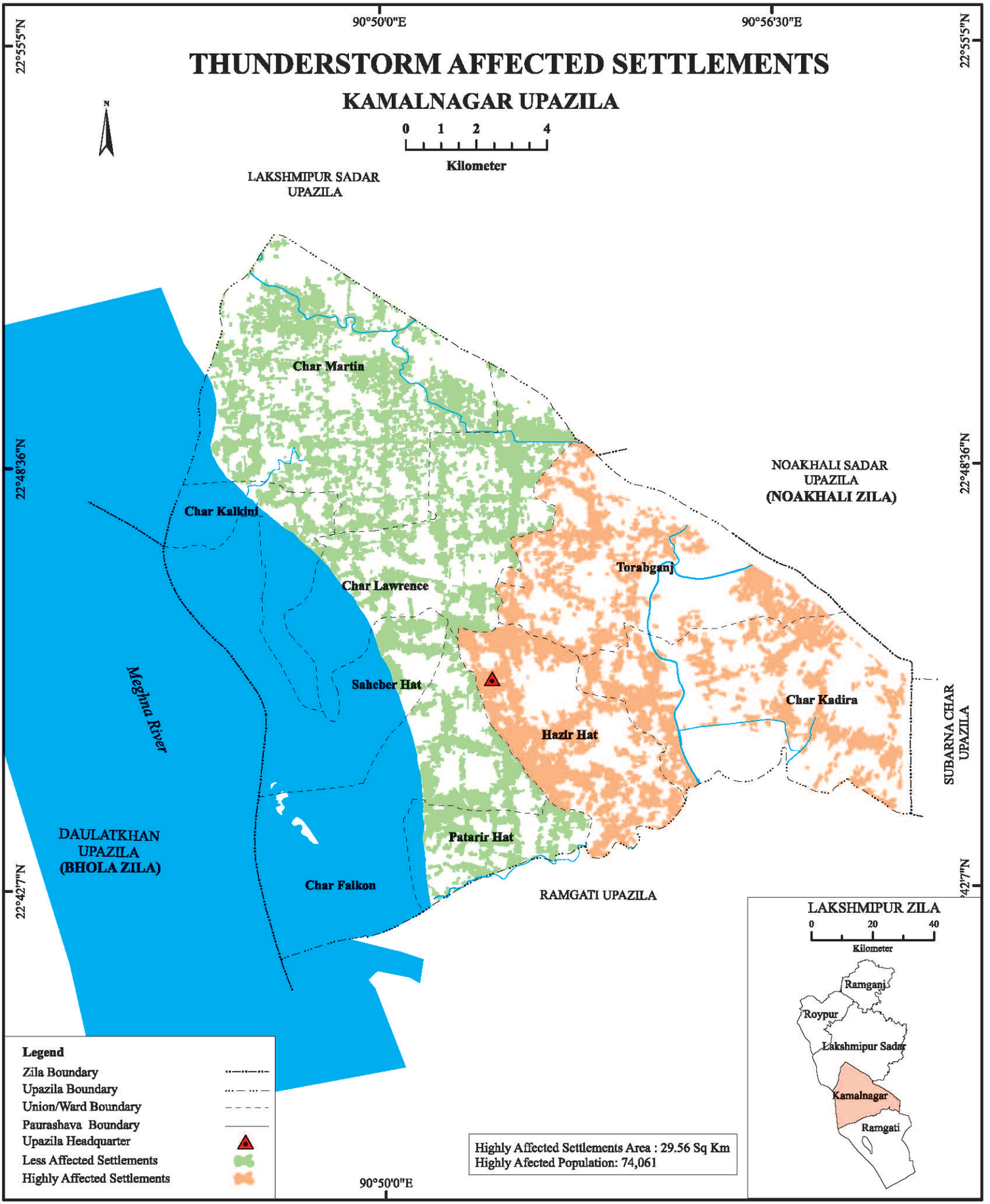


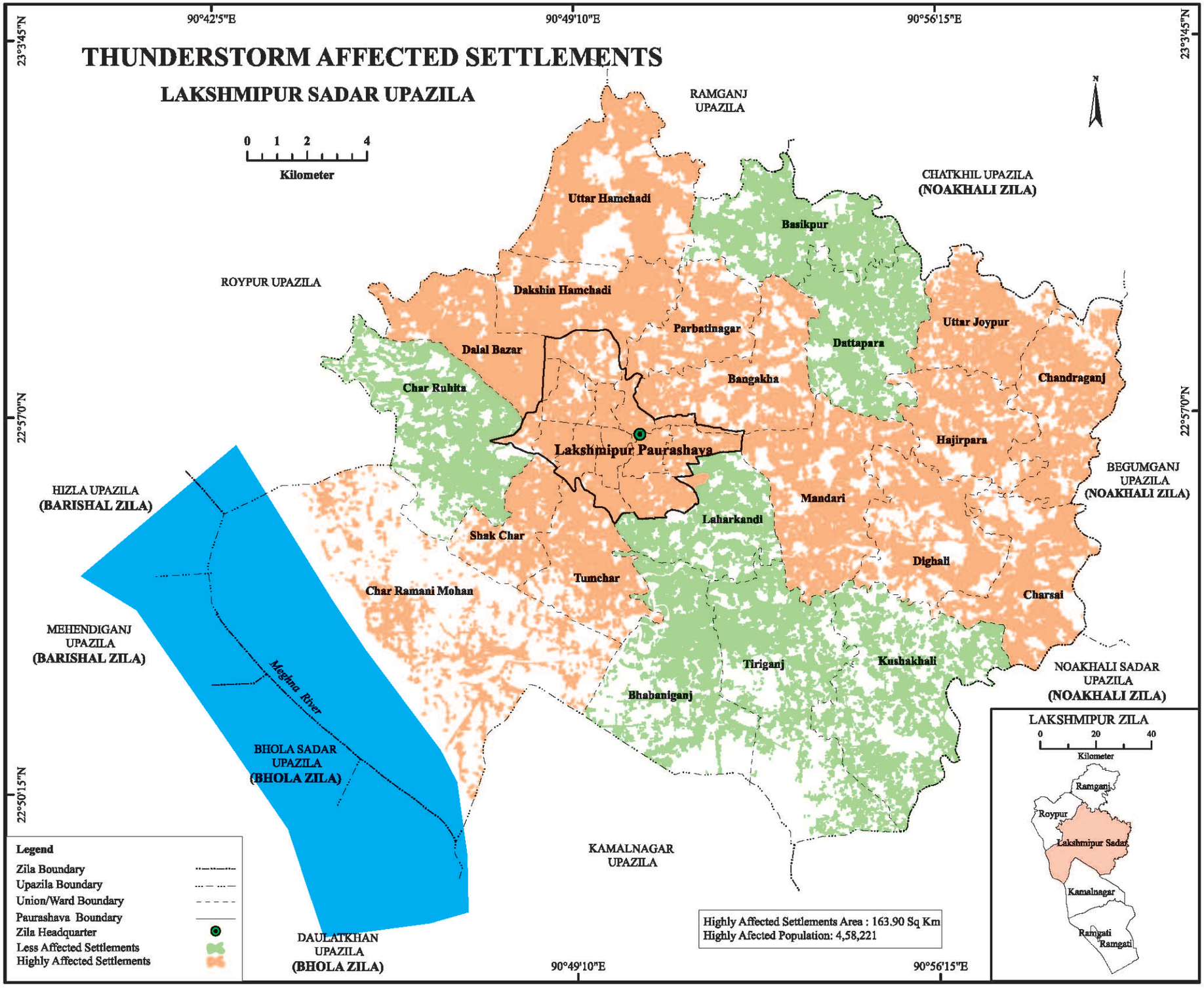


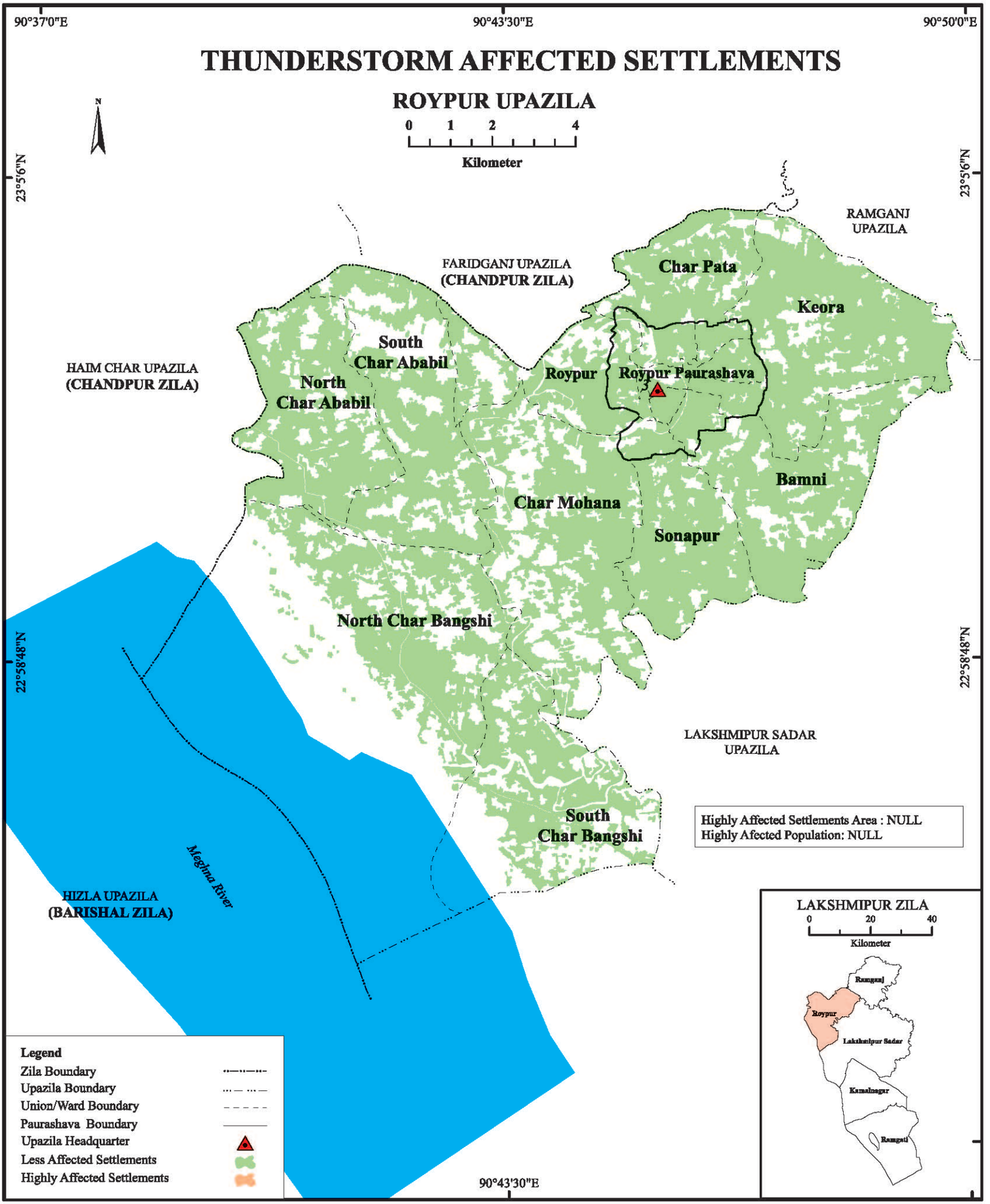


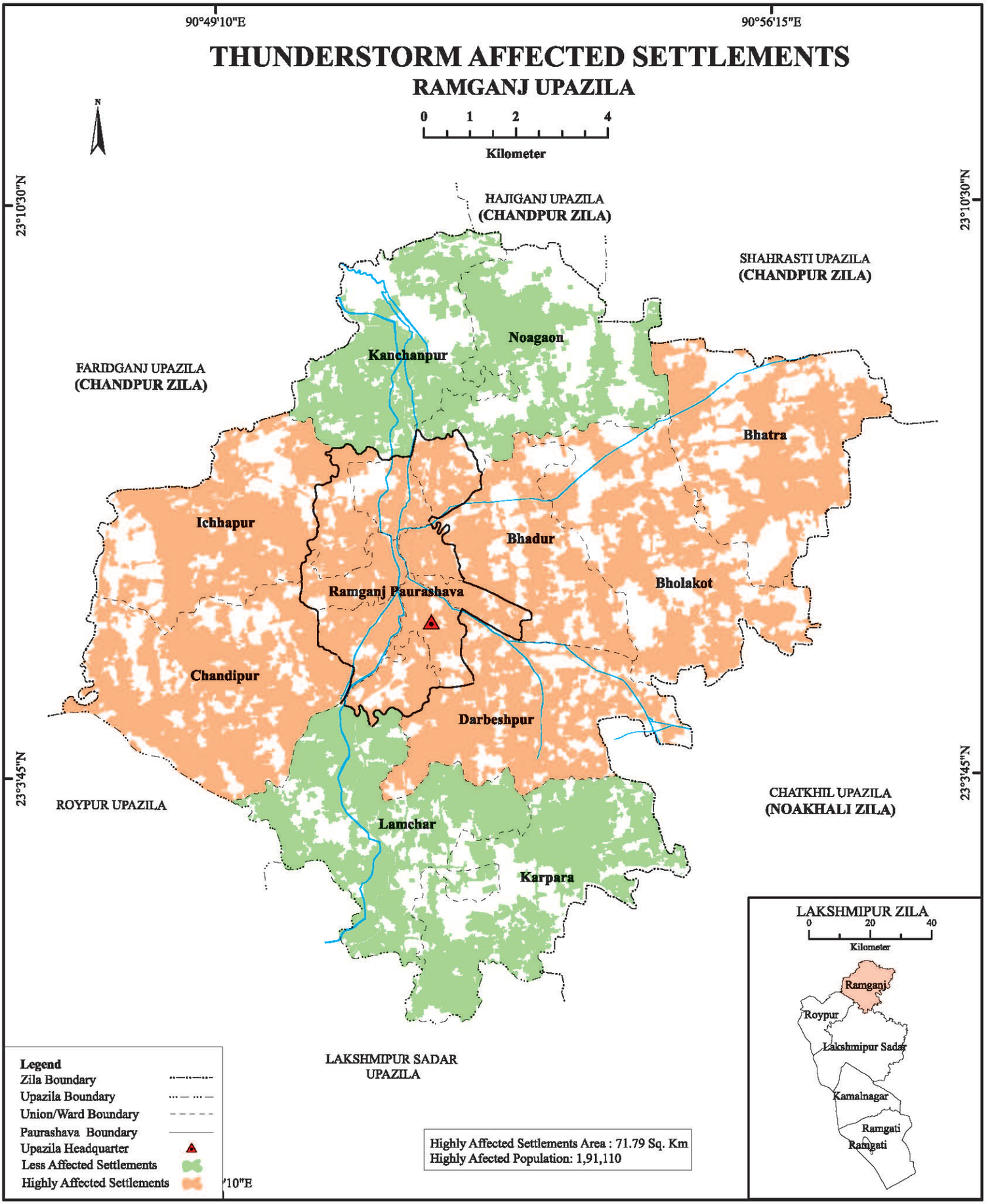
Thunderstorm Affected Area Map

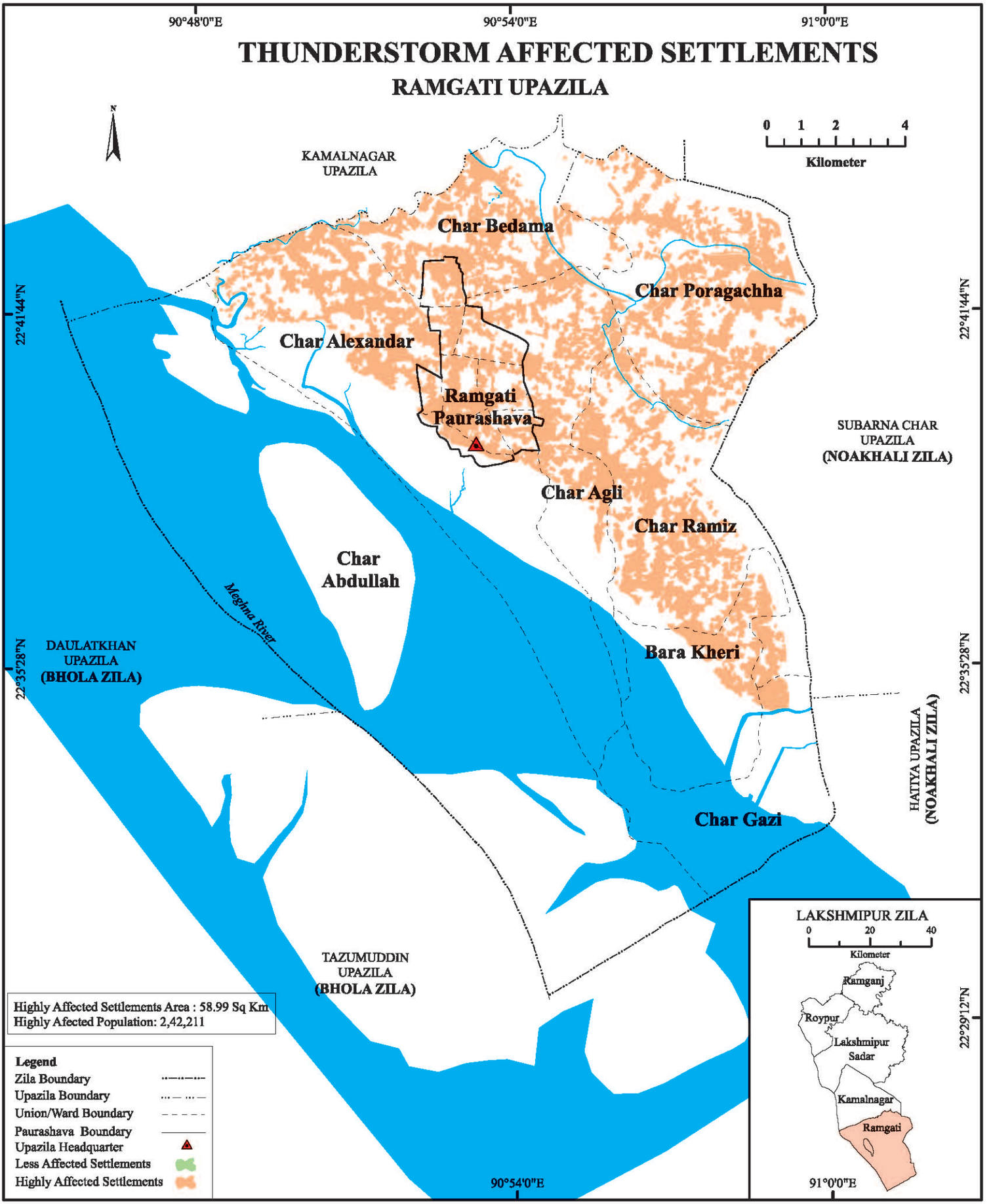




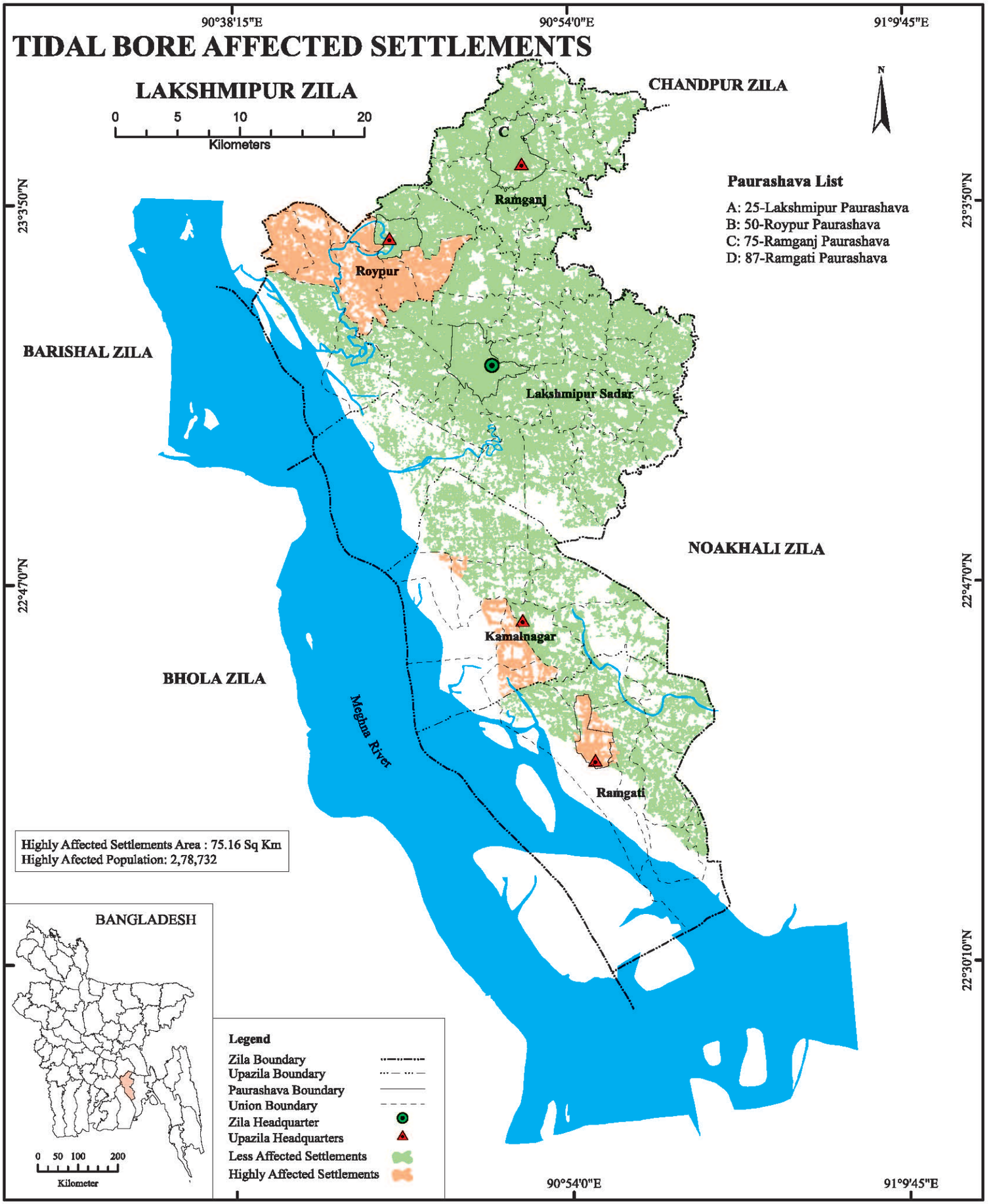


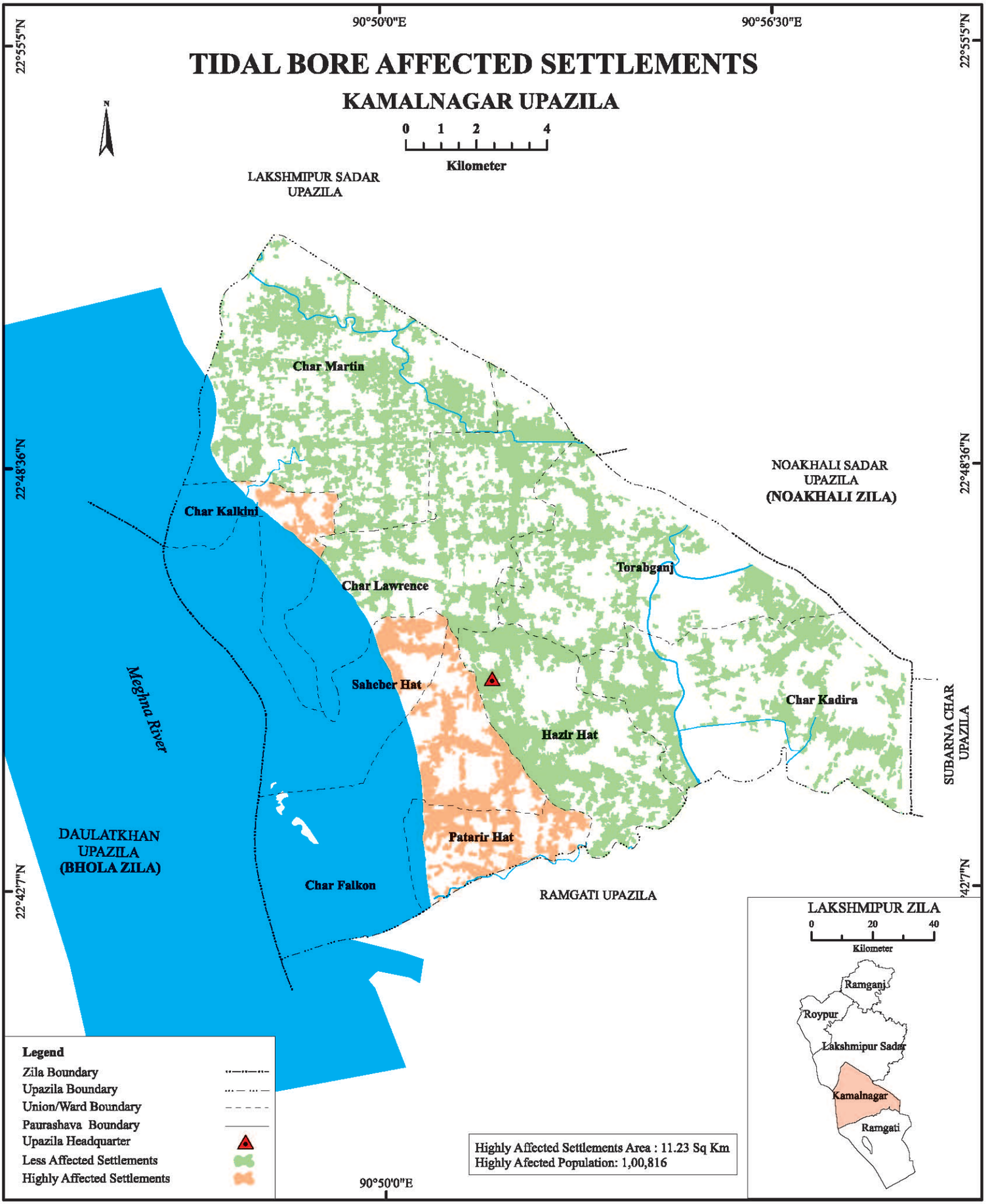






Tidal Bore Affected Area Map





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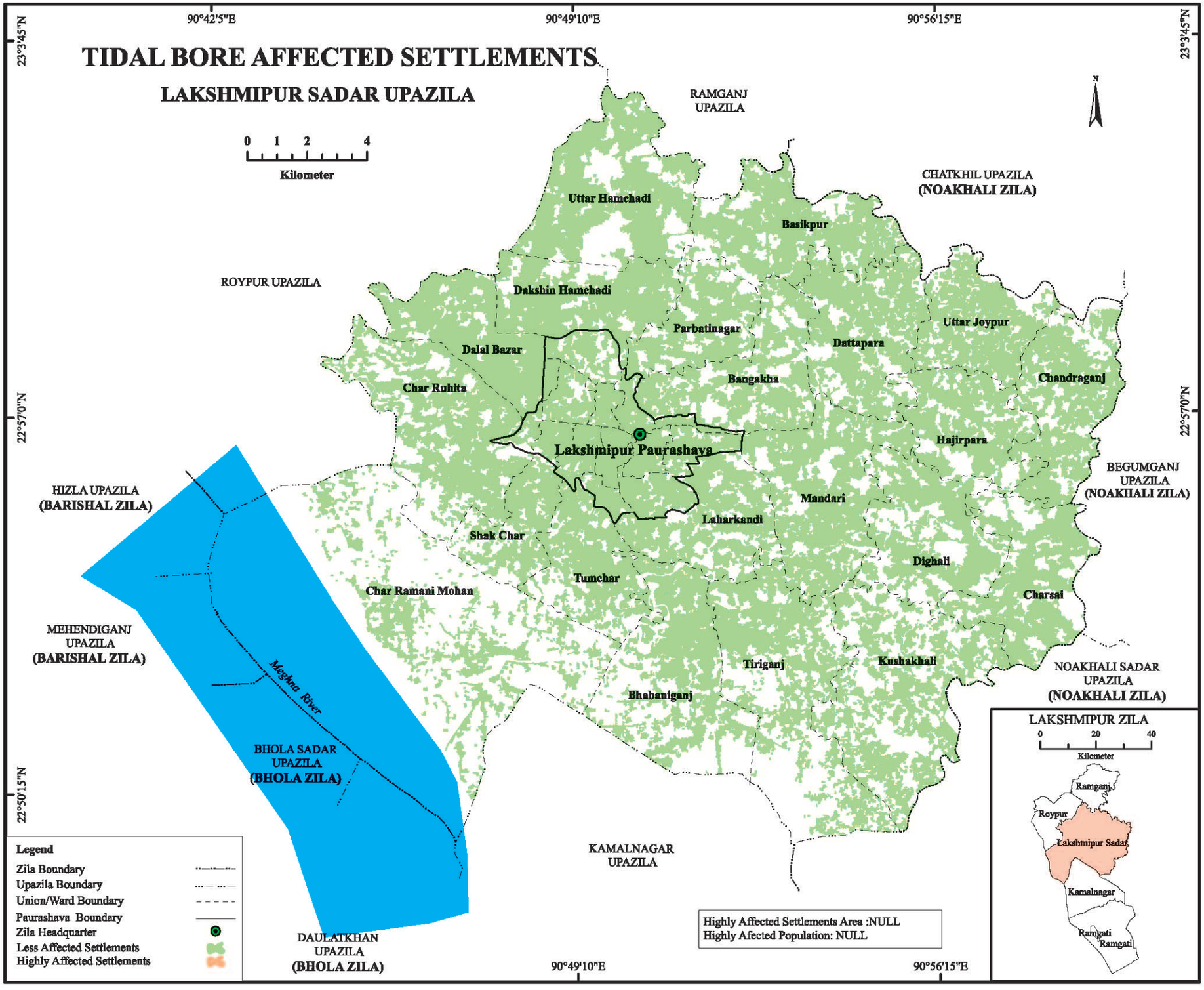

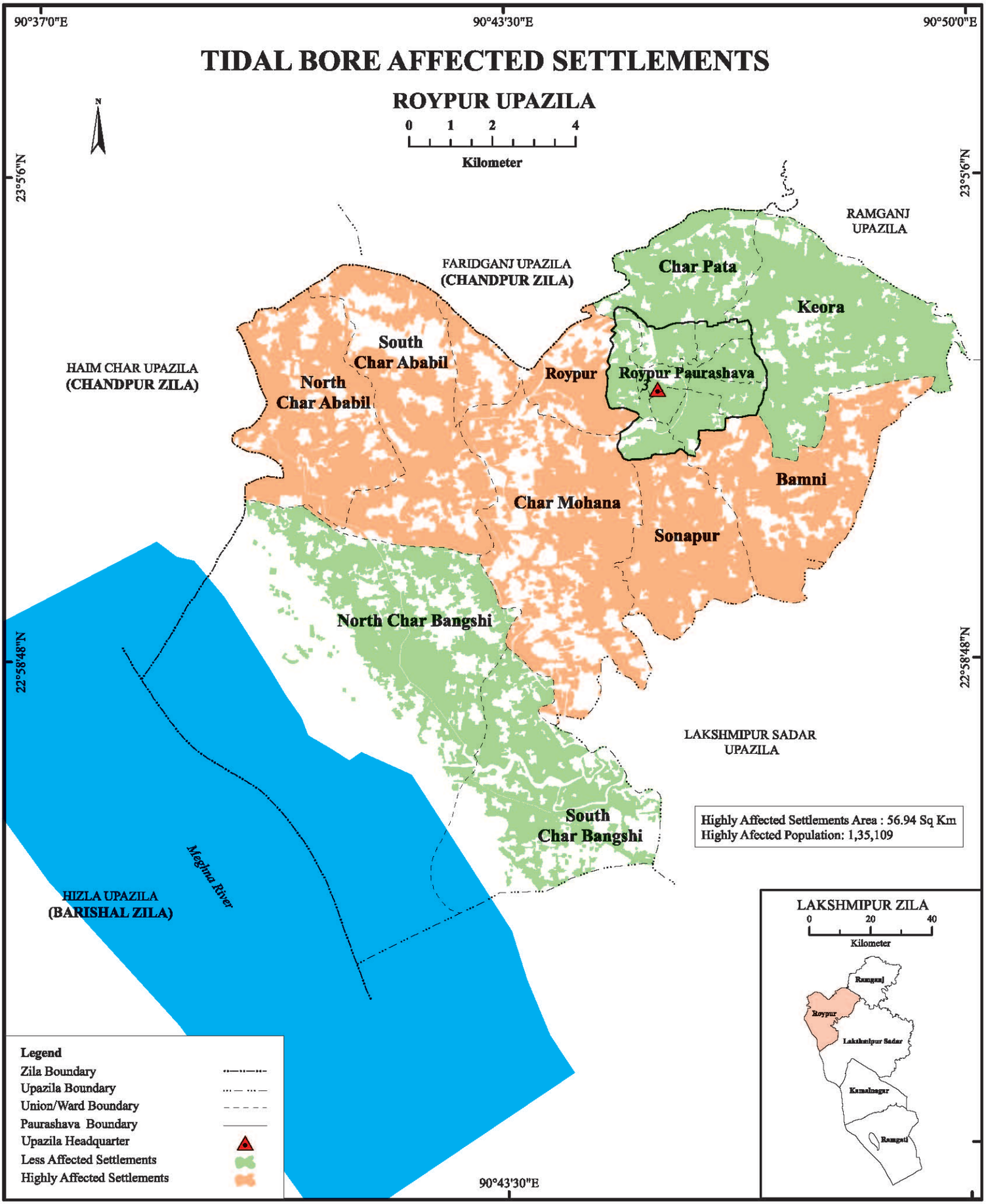

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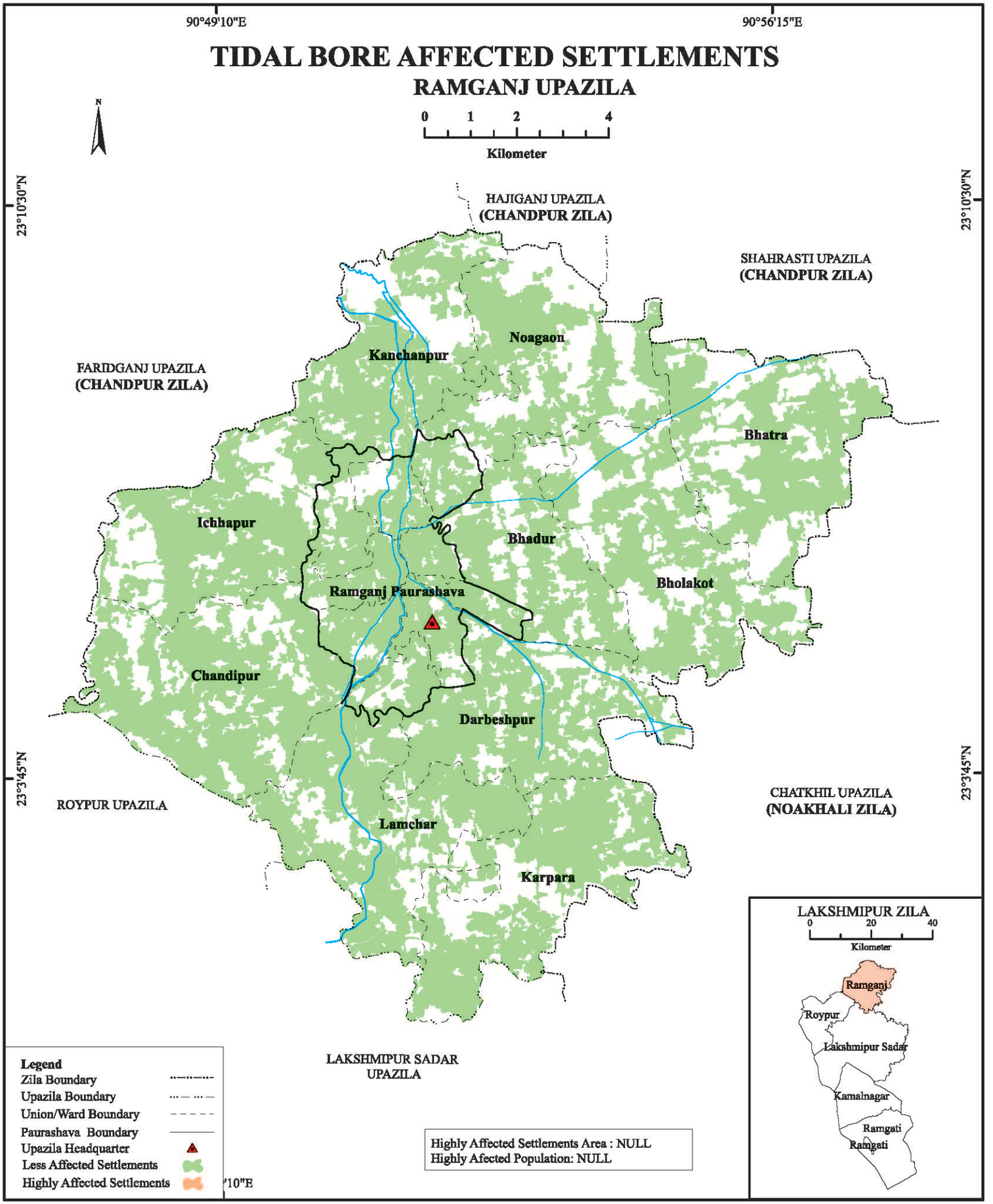
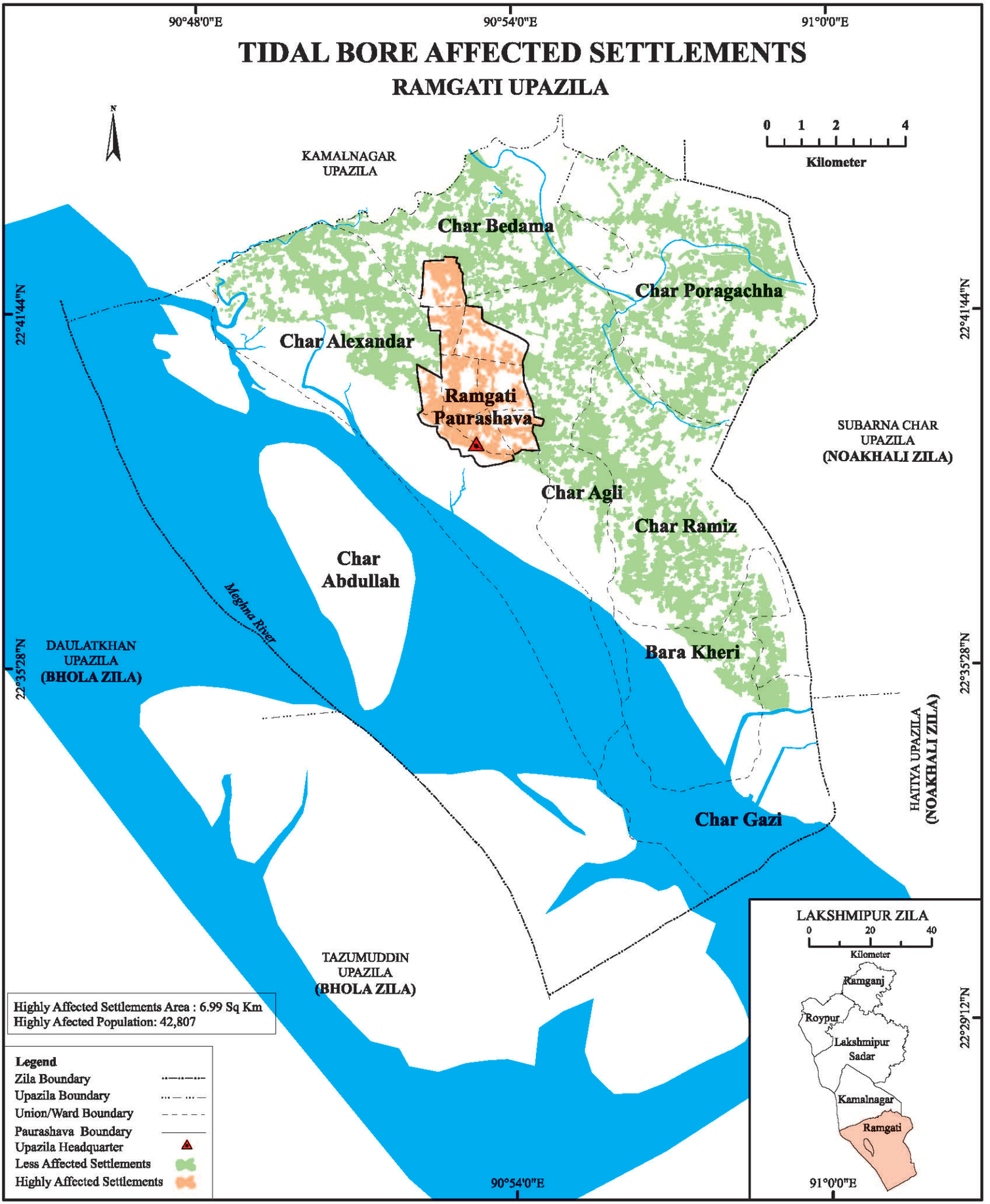
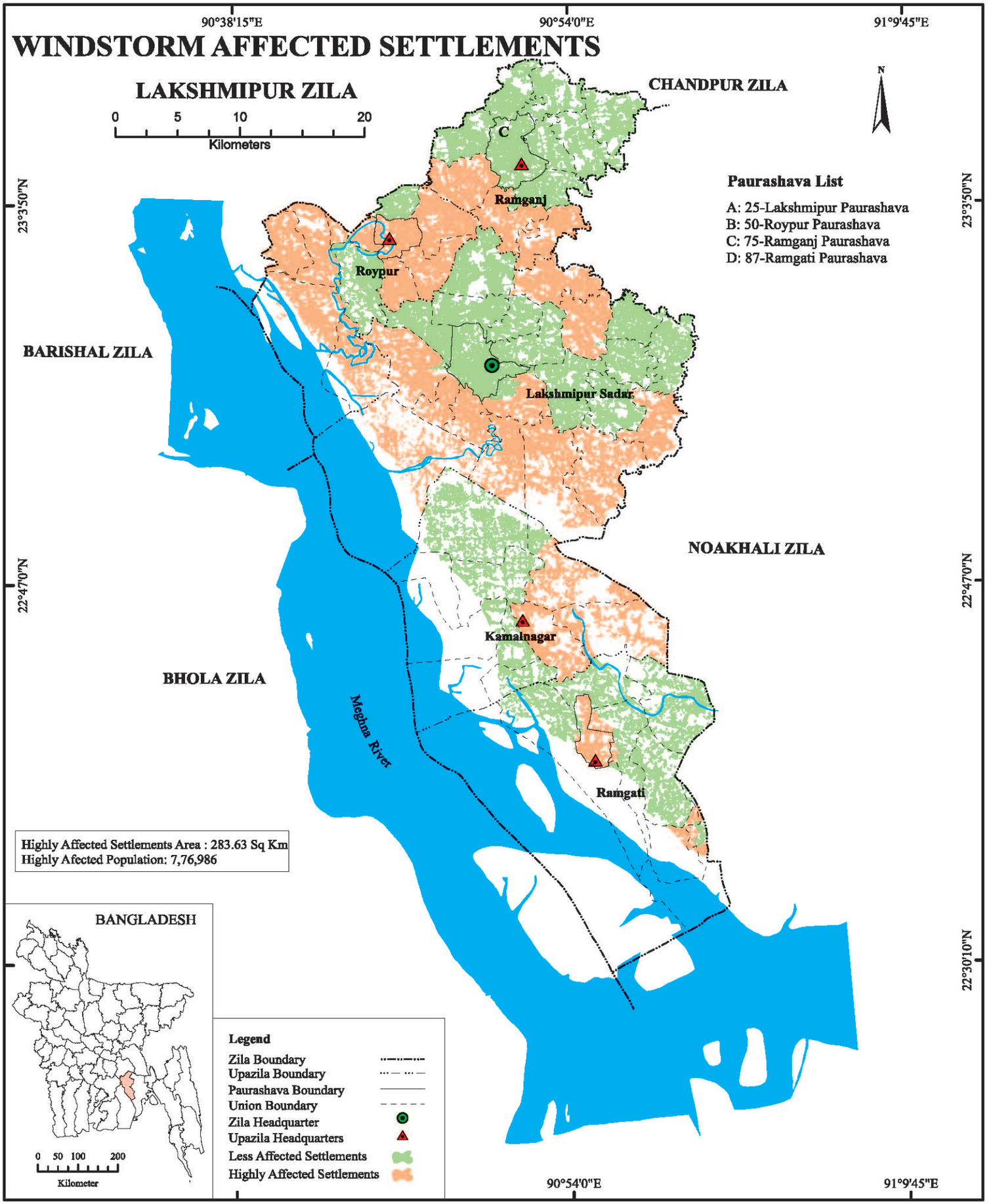
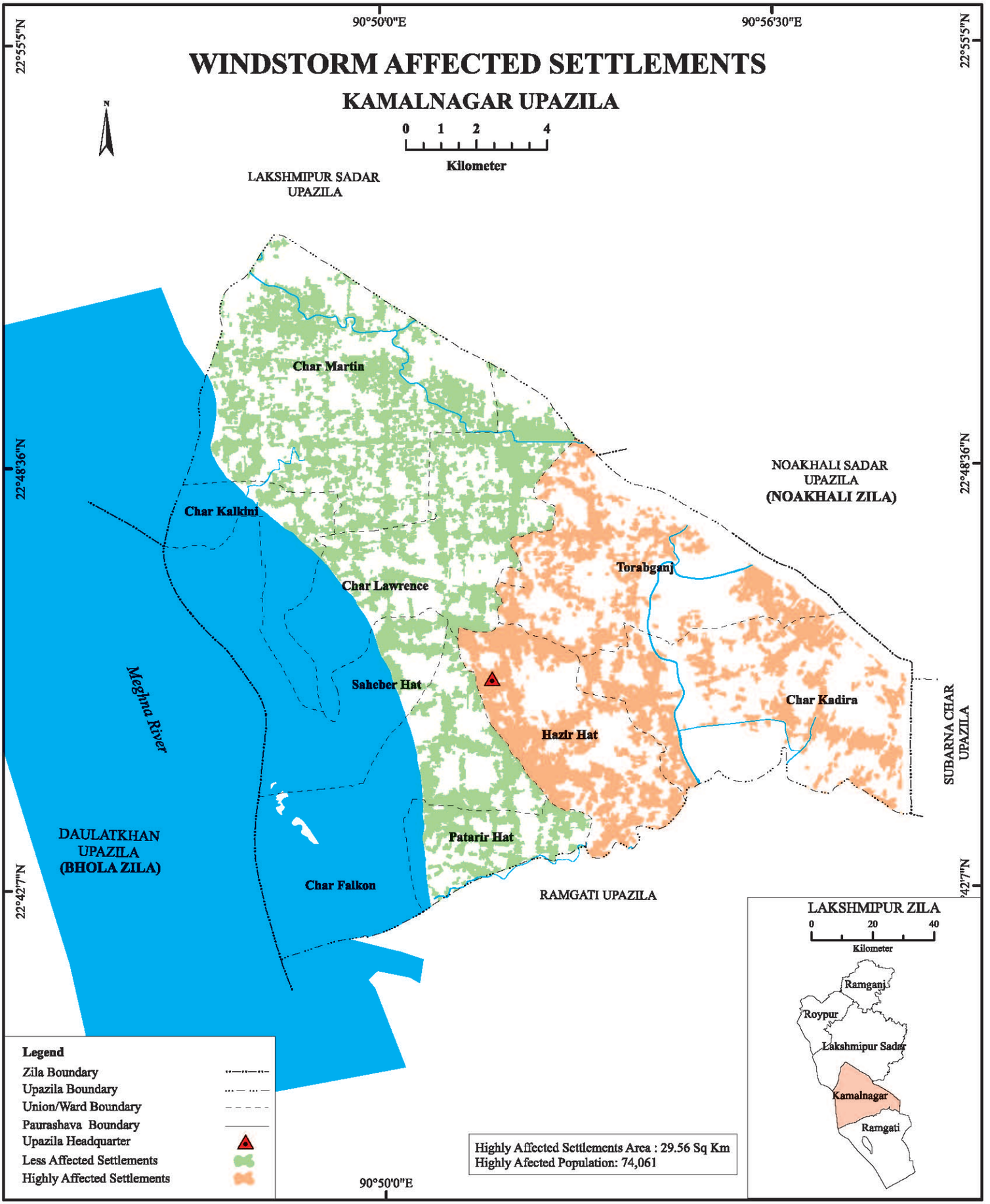
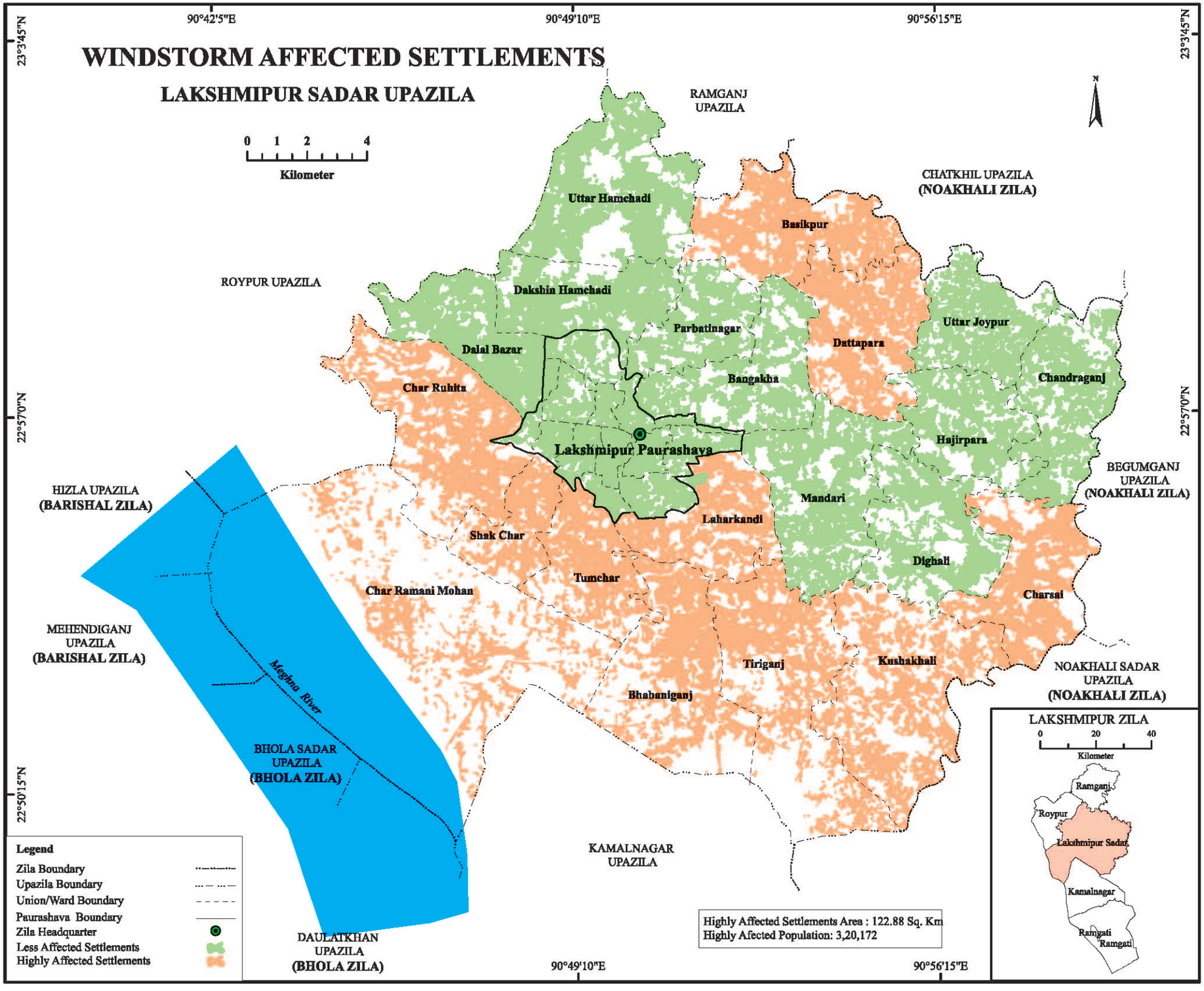


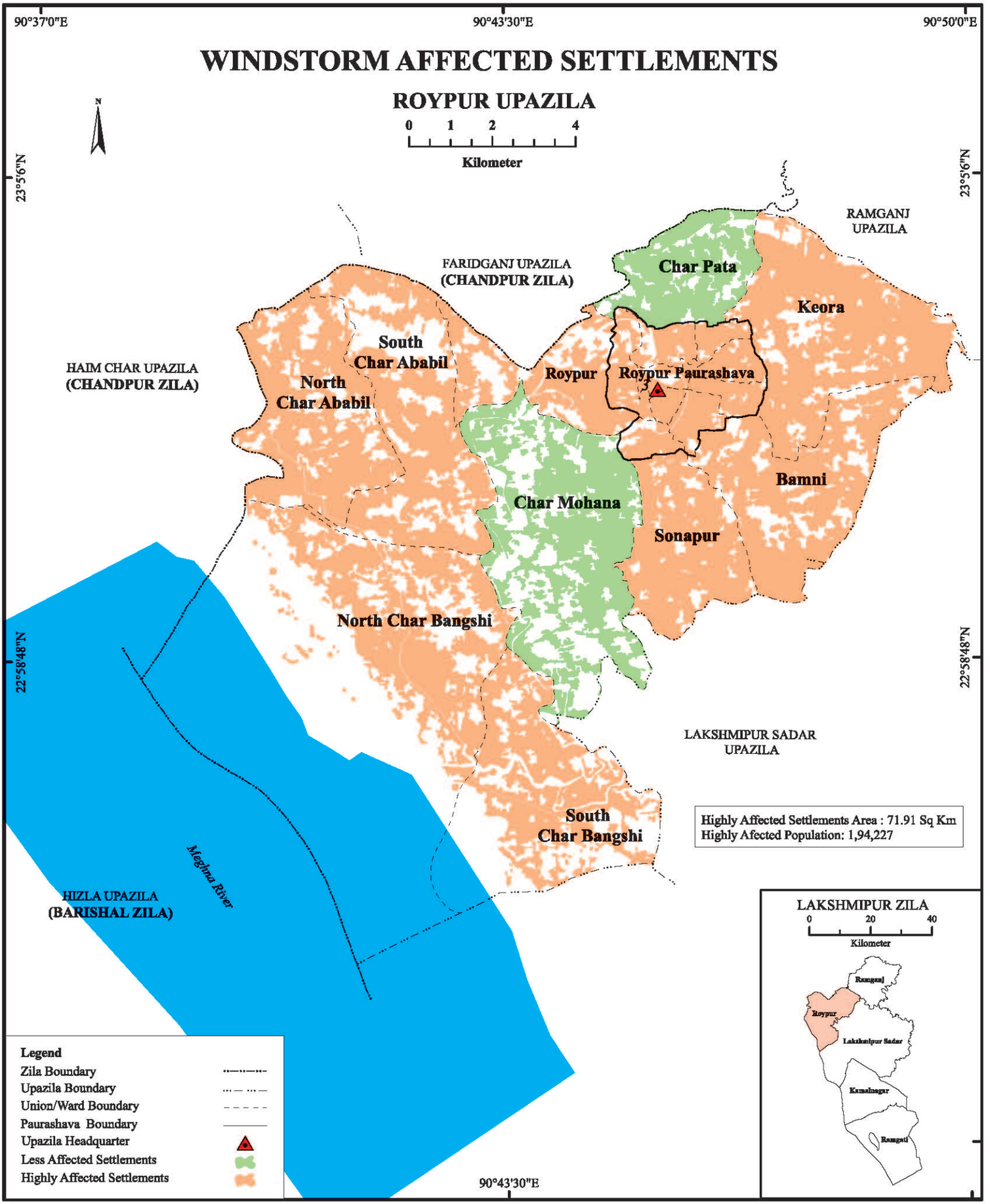


Windstorm Affected Area Map









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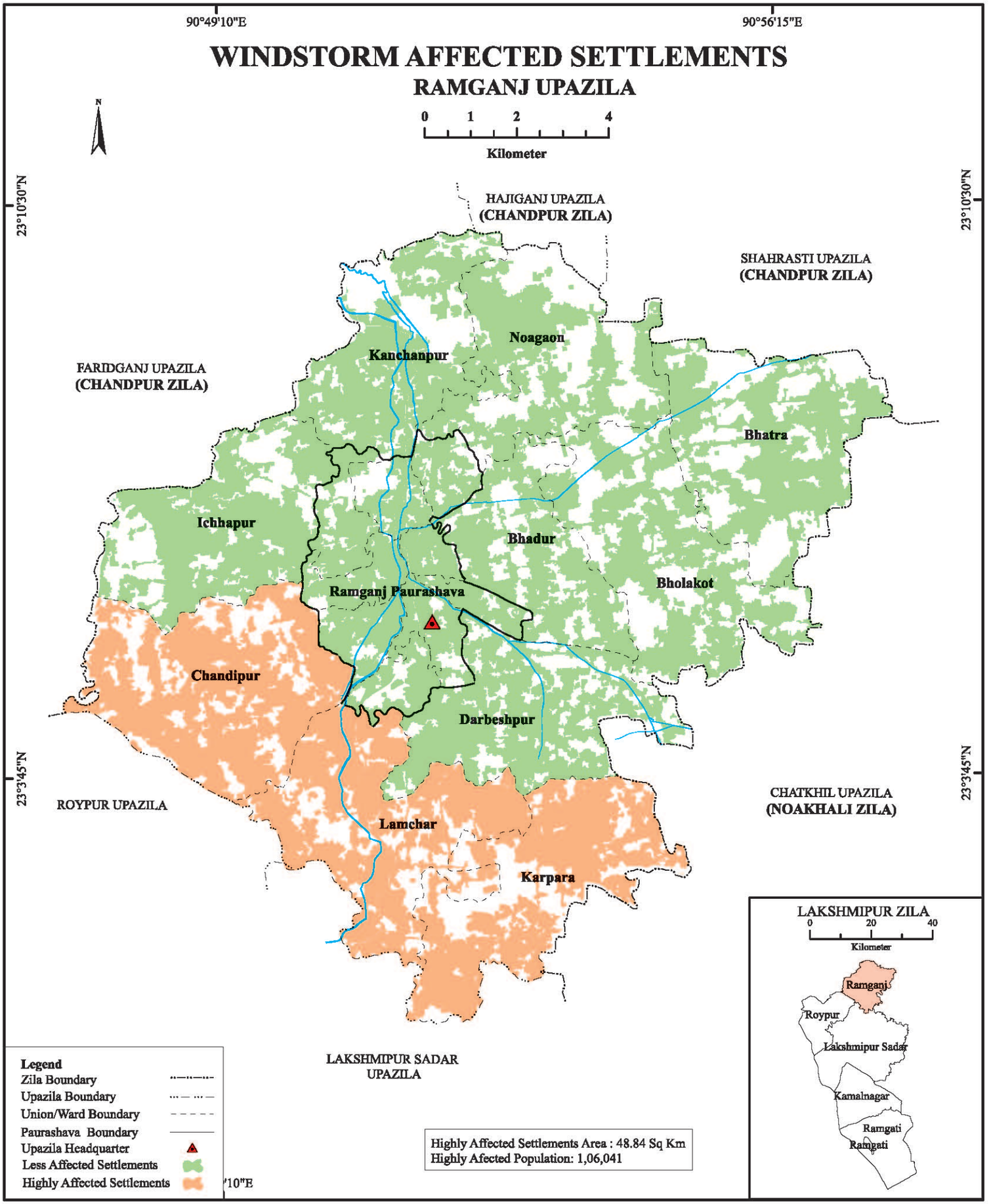
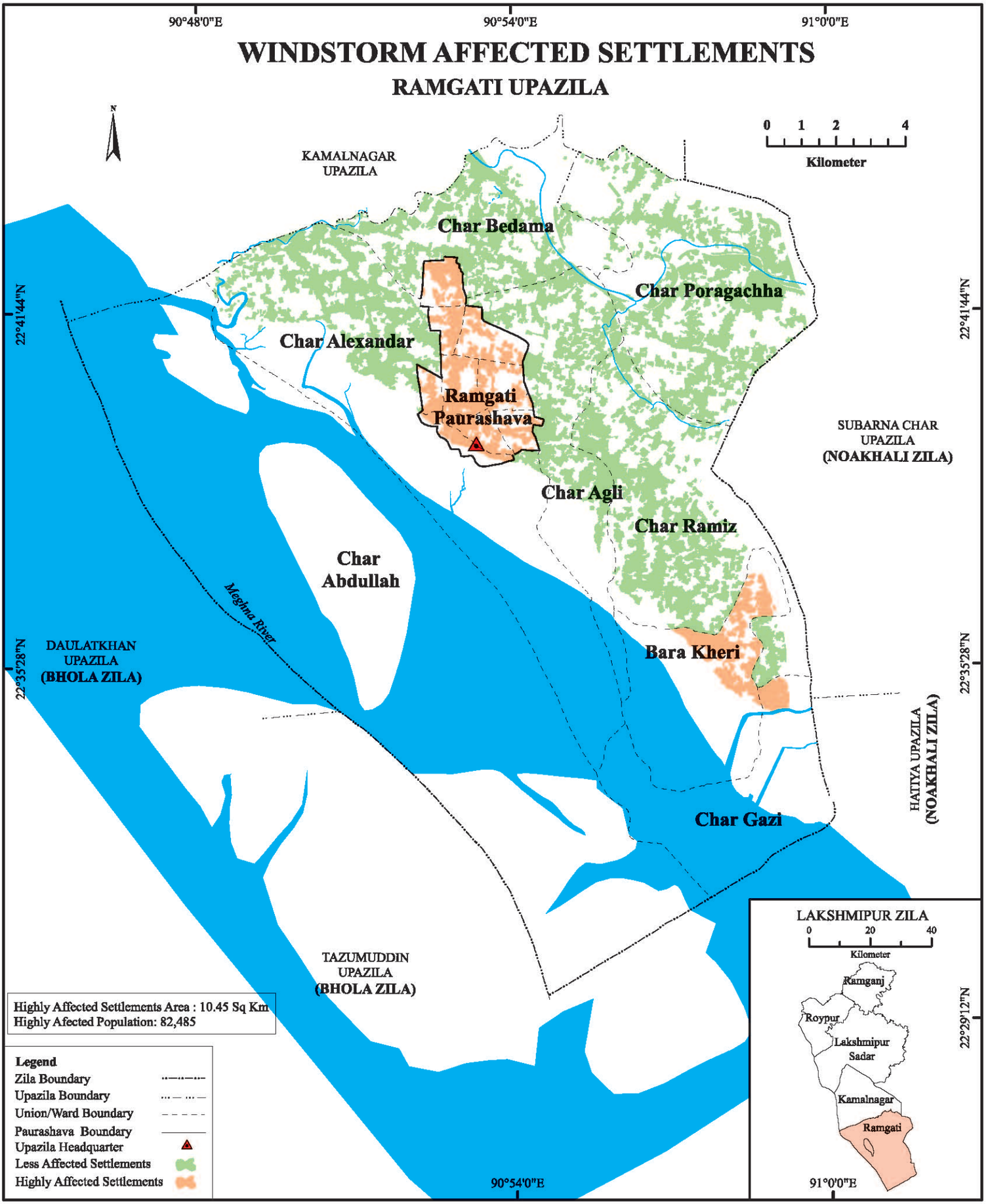
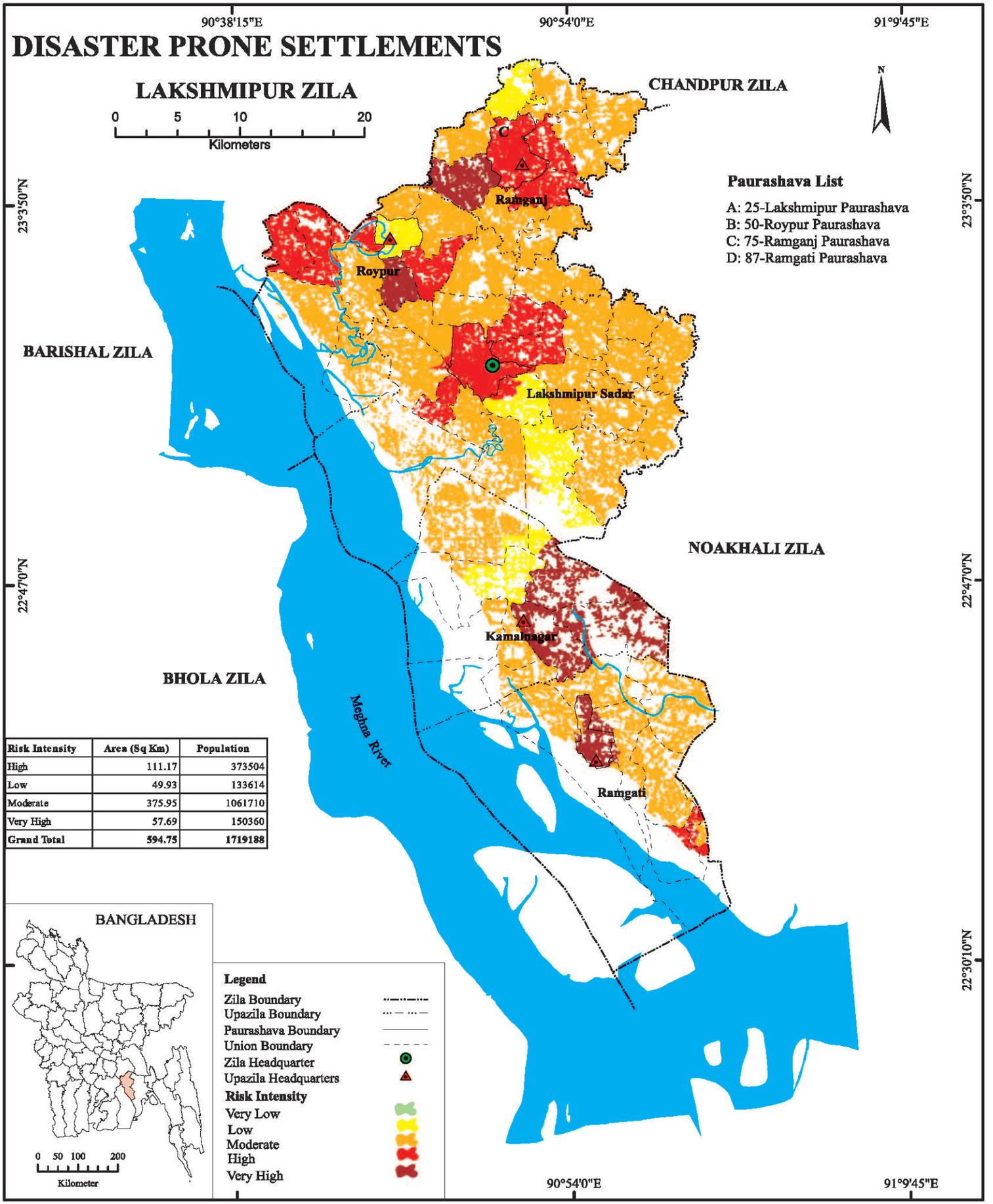


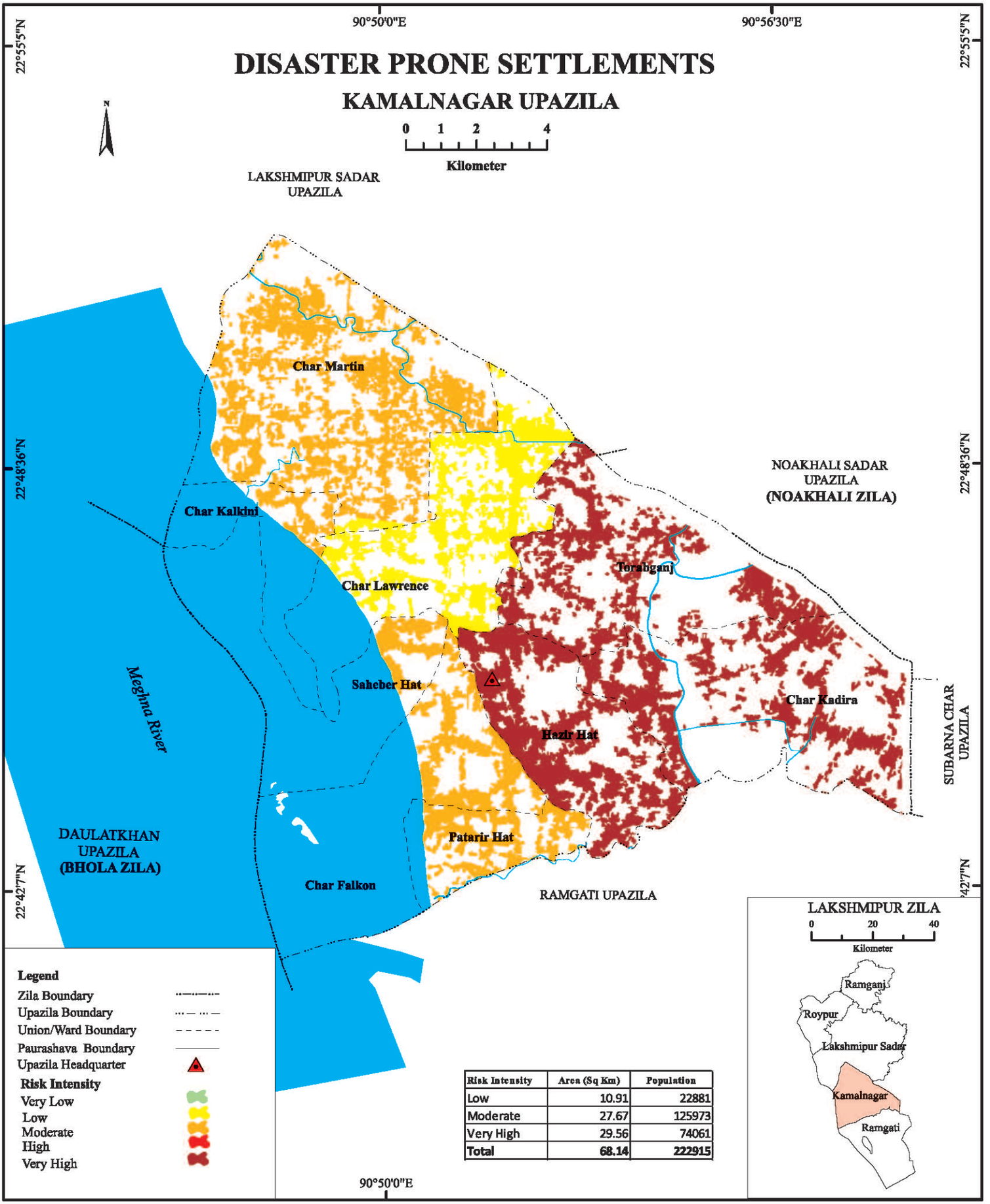


Disaster Prone Area Map

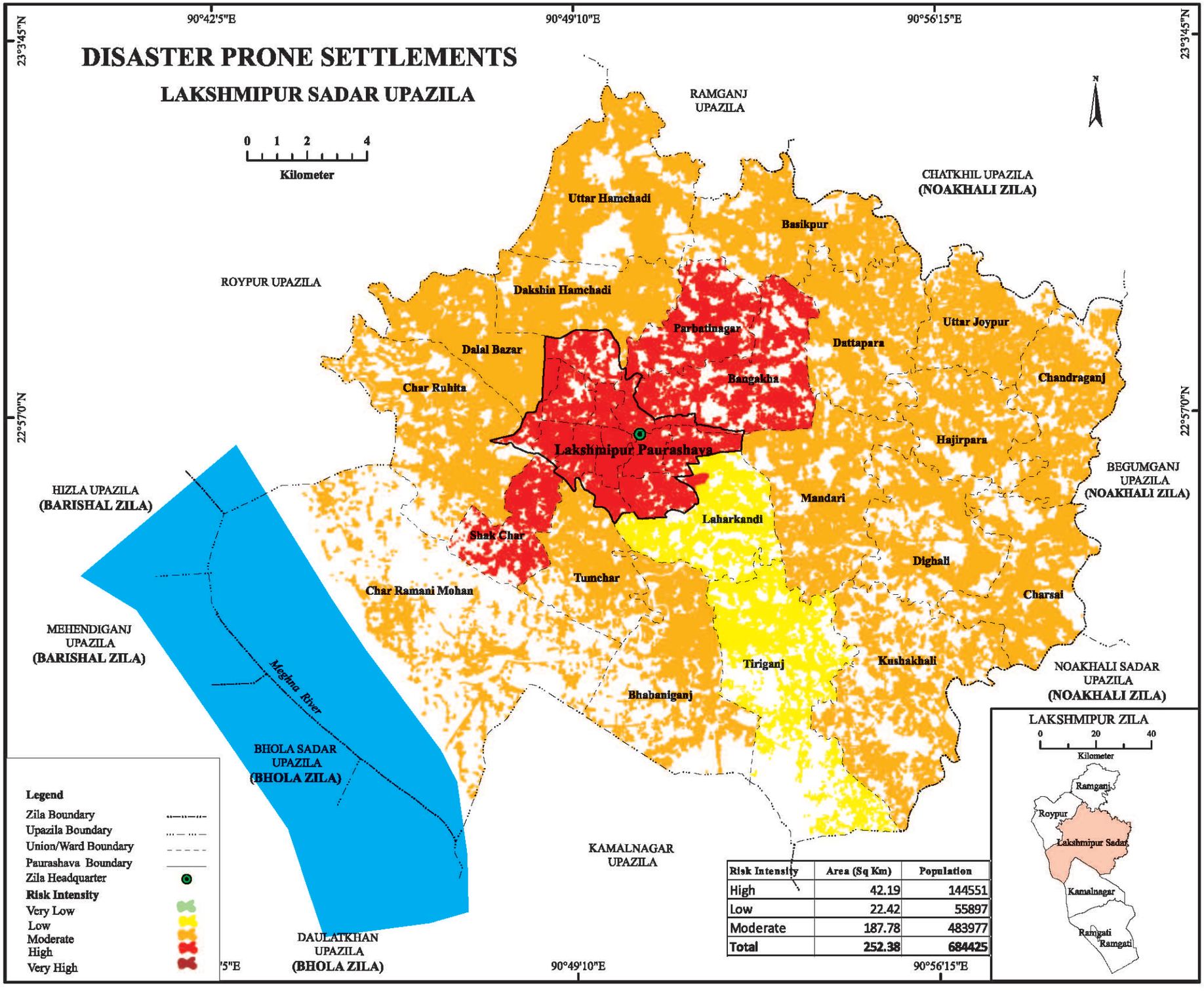
DISASTER PRONE SETTLEMENTS



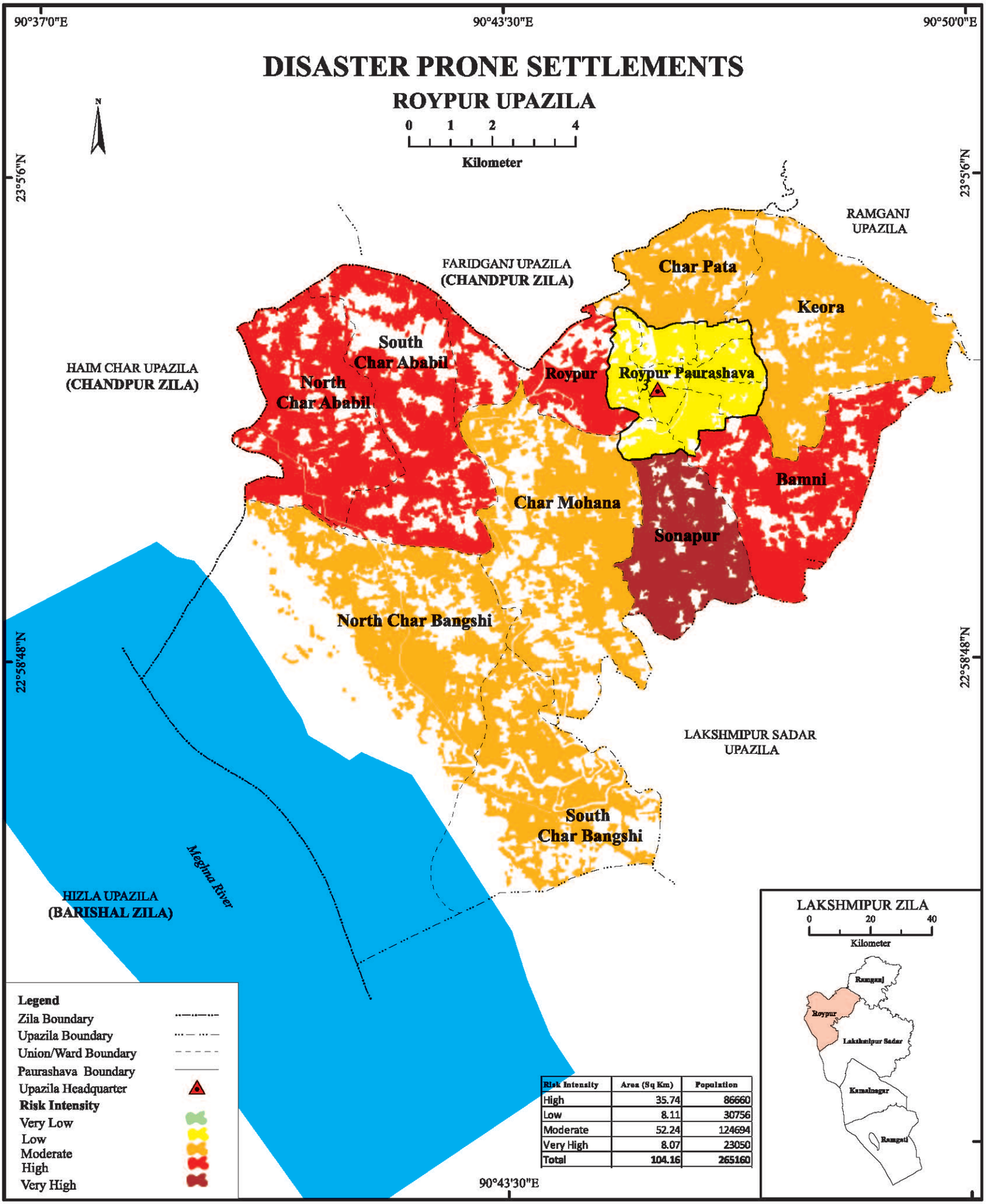
Risk Intensity	Area (Sq Km)	Population
High	111.17	373504
Low	49.93	133614
Moderate	375.95	1061710
Very High	57.69	150360
Grand Total	**594.75**	**1719188**



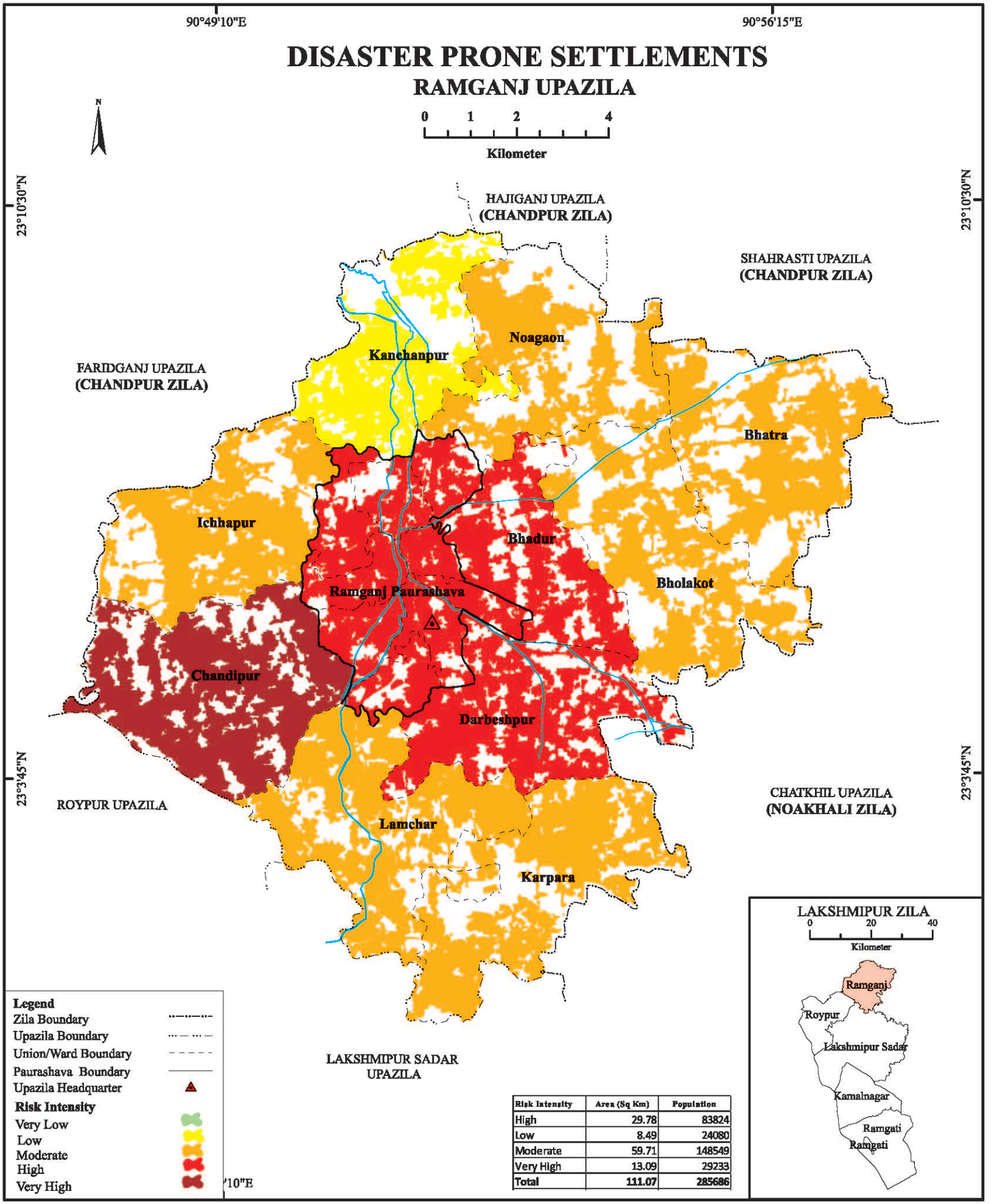
Risk Intensity	Area (Sq Km)	Population
Low	10.91	22881
Moderate	27.67	125973
Very High	29.56	74061
Total	68.14	222915



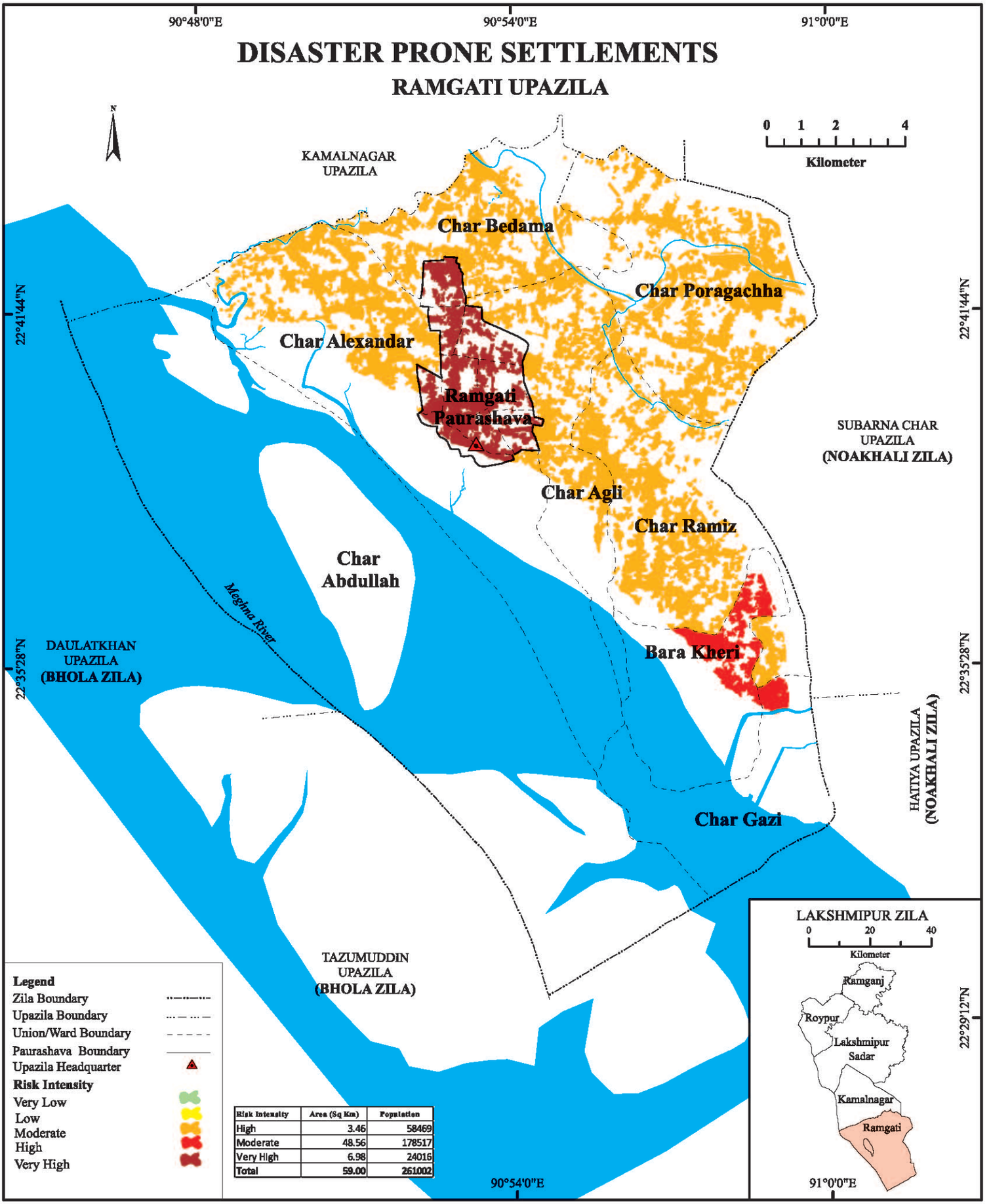
Risk Intensity	Area (Sq Km)	Population
High	42.19	144551
Low	22.42	55897
Moderate	187.78	483977
Total	252.38	684425



Stat4Dev Project, 2020



Risk Intensity	Area (Sq Km)	Population
High	29.78	83824
Low	8.49	24080
Moderate	59.71	148549
Very High	13.09	29233
Total	111.07	285686



Risk Intensity	Area (Sq Km)	Population
High	3.46	58469
Moderate	48.56	178517
Very High	6.98	24016
Total	59.00	261002

Appendix A

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁ, ঢাকা১২০৭

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

জেলার নামঃ কোডঃ	সিটি কর্পোরেশনের নামঃ কোডঃ	উপজেলার নামঃ কোডঃ	পৌরসভার নামঃ কোডঃ
ইউনিয়নের নামঃ কোডঃ	ওয়ার্ডের নামঃ কোডঃ	গ্রামের নামঃ কোডঃ	মহল্লার নামঃ কোডঃ

১. অবকাঠামো / স্থাপনার নামঃ			
২. অবকাঠামো / স্থাপনার অবস্থানঃ	অক্ষাংশ (Y):	দ্রাঘিমাংশ (X):	
৩. স্থাপনার প্রতিষ্ঠাকালঃ		৪.স্থাপনাটি কত তলাবিশিষ্টঃ	তলা
৫. স্থাপনার ধরন (অবকাঠামো):	**(নিচের নোট অনুযায়ী লিখুন)	পাঁকা 1	.আধা পাঁকা 2
৬. মোট কামরার সংখ্যাঃ		৭. মোট আয়তন (বর্গফুট):	বর্গফুট
৮. জেলার সংগে যোগাযোগের মাধ্যমঃ ৯. উপজেলার সংগে যোগাযোগের মাধ্যমঃ	ক. সড়কপথঃ কাঁচা / পাকা ..... কি.মি. ক. সড়কপথঃ কাঁচা / পাকা ..... কি.মি.	খ. জলপথ: ..... কি.মি. খ. জলপথ: .....কি.মি.	গ. রেলপথ: ..... কি.মি. গ. রেলপথ: ..... কি.মি.
১০. খোলা মাঠআছে কি?	হ্যাঁ 1	না 2	হ্যাঁ হলে,আয়তন (বর্গফুট): বর্গফুট
১১.বিদ্যুৎসুবিধা আছে কি?	হ্যাঁ 1	না 2	১২. টেলিভিশন আছে কি? হ্যাঁ 1 না 2
১৩. সংঘঠিত দুর্যোগের বিবরণঃ			

দূর্যোগের ধরণ (কোডসহ)	কারণ (কোডসহ)	সময়কাল (কোডসহ) (কোন মাসে)	উৎস(কোডসহ) (প্রাকৃতিক/ মানবসৃষ্ট)	স্থায়িত্ব (দিন/মাস)	ব্যাপ্তি (মৌজা /গ্রামের নাম)	কত দিন পর পর সংঘঠিত হয়	গত ৫ বছরে কতবার সংঘঠিত হয়েছে

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

দুর্যোগ কালীন সময়ে লোকজনদের আশ্রয়স্থল, অসুস্থ লোকজনদের জরুরি চিকিৎসার জন্য ফিল্ড হাসপাতাল স্থাপনের জায়গা, জরুরী 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 নামঃ পিতার নামঃ মাতার নামঃ বয়সঃ পেশাঃ মোবাইল নম্বরঃ	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
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ই-২৭/এ, আগারগাঁ, ঢাকা১২০৭

Paurashava/Union Wise Disaster Calendar for Coastal Area of Bangladesh

জেলার নামঃ কোডঃ	সিটি কর্পো: নামঃ কোডঃ	উপজেলার নামঃ কোডঃ	পৌরসভার নামঃ কোডঃ	ইউনিয়নের নামঃ কোডঃ	ওয়ার্ডের নামঃ কোডঃ

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 নামঃ পিতার নামঃ মাতার নামঃ বয়সঃ পেশাঃ মোবাইল নম্বরঃ	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

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