National Disaster Management Authority Pakistan

Infrastructure Risk Atlas

Infrastructure Advisory &
Project Development Wing

Chairman's Message

Pakistan is among the top 10 countries most affected by climate change, with increasingly erratic weather patterns exposing the country to various natural disasters. Past disasters have revealed the vulnerability of infrastructure, particularly residential buildings, which have caused significant financial and human losses. Weaknesses in construction and planning have contributed to these devastating impacts.

To address this, there was a clear need to identify and assess the risks faced by residential infrastructure across Pakistan. This Risk Atlas specifically maps the level of risk at the district level, based on the structural distribution of buildings and their susceptibility to earthquake and flood hazards.

The primary goal of this publication is to assist both government organizations and private entities in proactively identifying communities most in need of support, based on their infrastructure vulnerabilities. By providing this detailed risk assessment, the Atlas aims to improve resource allocation and guide policy development for more effective disaster prevention, resilience building and long-term urban planning. I hope that this will help protect lives and assets in the face of growing climate challenges.

Lt. Gen Inam Haider Malik HI(M)
Chairman NDMA
Dec 2024

Acknowledgements / Preface

Table of Content

Introduction

Pakistan is the 5th most vulnerable country that is positioned strategically at the crossroads of South Asia, Central Asia and the Middle East. It is a country with rich historical legacy, diverse culture and economic potential. However, it faces multiple economic and environmental challenges. The geographical setting of Pakistan makes it susceptible to various hazards. It lies on the conflux of several tectonic plates, including the Indian, Eurasian and Arabian plates which makes it vulnerable to a number of geographical hazards. These natural hazards ranging from earthquakes and floods to landslides, droughts and cyclones, pose a significant risk to the country's infrastructure, economy and the well-being of its population.

The northern and western regions, located in the seismically active Himalayan Mountain range, are prone to catastrophic earthquakes due to major fault lines like the Main Mantle Thrust (MMT) and the North-South Fault. The 2005 earthquake, with a magnitude of 7.6, caused over 80,000 deaths and widespread infrastructure damages, highlighting the need for seismic risk assessments to protect infrastructure.

Additionally, the country faces extreme weather events, including monsoon floods, particularly affecting the Indus River plains of Punjab and Sindh. Flooding, exacerbated by poor urban planning, inadequate flood protection and deforestation, regularly damages infrastructure. The 2010 floods, which affected nearly one-fifth of the country and the devastating 2022 floods, causing around $30 billion in damages, emphasize the urgent need for assessing flood risks to safeguard Pakistan's infrastructure.

Purpose of Risk Atlas

The formulation of Infrastructure Risk Atlas is Pakistan's pioneering initiative to systematically address the pressing gap in data on the country's building infrastructure. Despite being highly disaster-prone, Pakistan lacks a comprehensive database that records critical information about its infrastructure, including the type, condition and vulnerabilities of buildings. This absence of data has made it challenging to assess the structural risks posed by natural disasters such as earthquakes, floods and storms, as well as human-induced hazards. The Infrastructure Risk Atlas aims to fill this void by providing a detailed and holistic understanding of infrastructure conditions across the country.

This Risk Atlas will be instrumental in identifying districts that are densely populated with structurally weak and vulnerable buildings. Such insights will allow policymakers to pinpoint regions where immediate interventions are necessary to mitigate risks. By highlighting the geographical distribution of infrastructure vulnerabilities, the Atlas will guide efforts in prioritizing disaster risk reduction initiatives. It will also aid in fostering a more focused approach toward capacity-building and retrofitting programs, ensuring that high-risk regions receive adequate attention.

Furthermore, the Infrastructure Risk Atlas will serve as a critical decision-making tool for both government agencies and private sector stakeholders. By enabling more informed and efficient allocation of resources, it will enhance the country's ability to respond to and recover from future disasters. This initiative represents a significant step toward improving Pakistan's overall infrastructure resilience, ultimately supporting in building a safer and more sustainable future.
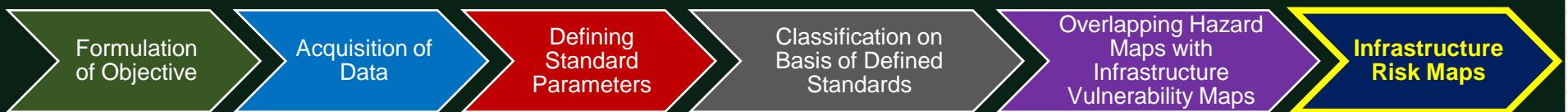
Methodology for Formulation of Risk Atlas

A proper systematic methodology was adopted for compilation of the Infrastructure Risk Atlas. It consists of five phases which are depicted graphically in the flow chart:

Formulation of Objective → Acquisition of Data → Defining Standard Parameters → Classification on Basis of Defined Standards → Overlapping Hazard Maps with Infrastructure Vulnerability Maps → **Infrastructure Risk Maps**

a. Formulation of Objective:

The first step in compilation of the infrastructure risk atlas was defining the objectives. Three objectives were formulated which are as follows:

- To classify the residential infrastructure of Pakistan into various building types
- To assess the vulnerability of identified structural types
- To formulate an infrastructure risk atlas for residential structures of Pakistan

Methodology for Formulation of Risk Atlas

b. Acquisition of Data:

After the formulation of objectives, data was acquired from the Pakistan Bureau of Statistics regarding the total number of houses in Pakistan. This data was gathered and maintained district wise.

c. Defining Standard Parameters:

In this step literature review was performed to determine standard parameters for the classification of residential structures. Various research papers were reviewed and ultimately European Macro Seismic Scale (EMS-98) was modified for Pakistan and selected for classifying the structures into various types. This standard describes the classification parameters on the basis of roof and wall types.
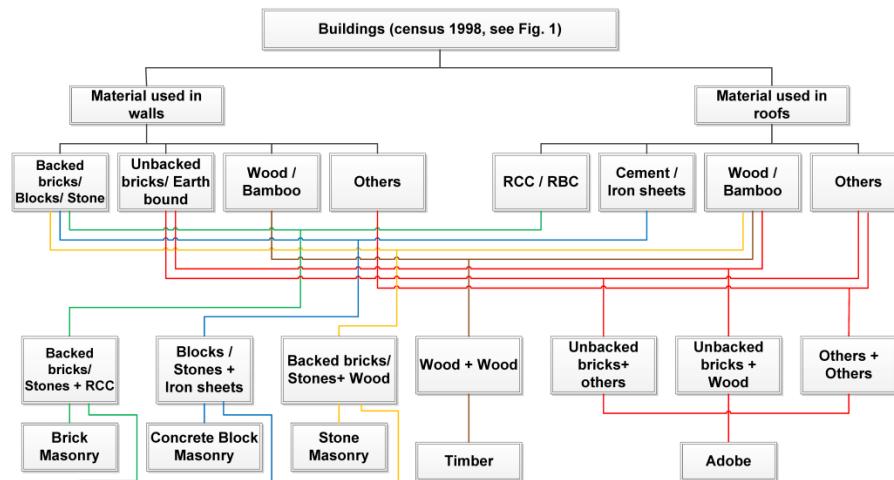
Figure 1: *Classification parameters for defining structure types*
Source: *Elaboration of Multi-Hazard Zoning and Qualitative Risk Maps of Pakistan by Muhammad Shahid Siddique*

Methodology for Formulation of Risk Atlas

These parameters were then used to classify the residential infrastructure into the following categories:

| Adobe Structures | Block Masonry | Stone Masonry | Brick Masonry | Wooden Structures |

d. Classification on Basis of Defined Standards:

Afterwards, the vulnerability of various identified structural types was determined according to EMS-98 modified for Pakistan and Building Resilience Index vulnerability score which resulted in ranking of the identified structural types against Earthquake and Flood hazards.

Methodology for Formulation of Risk Atlas

The table 1 shows the vulnerability score derived from MHVRA, NDMA which was used for different types of structures against earthquake and flood hazards.

e. Formulation of Infrastructure Risk Maps:

In the last step, hazard maps of earthquake and flood that have already been compiled by NDMA on district level were overlaid with vulnerability maps in order to generate district wise infrastructure specific risk maps.

Type of Structures	Vulnerability Score	
	Flood Hazard	Earthquake Hazard
Brick Masonry	3.66	3.79
Block Masonry	4.24	5
Stone Masonry	5.4	5.56
Timber	4.82	2.5
Adobe	7.14	7.14
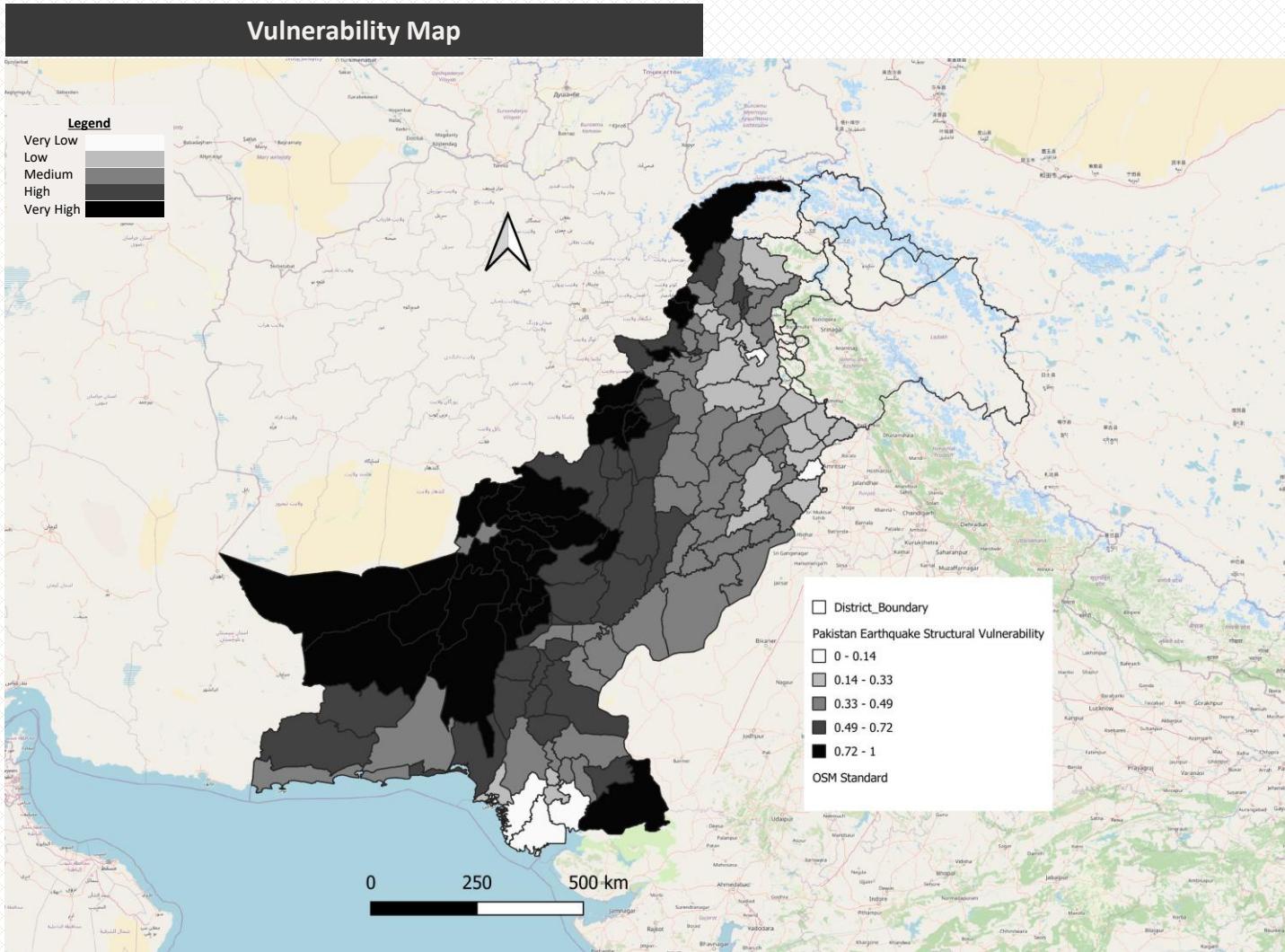
Table 1: Vulnerability score of structures against flood and earthquake hazard
Source: *MHVRA NDMA, Pakistan*

National Maps

Earthquake Hazard

Vulnerability Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

District_Boundary

Pakistan Earthquake Structural Vulnerability
- 0 - 0.14
- 0.14 - 0.33
- 0.33 - 0.49
- 0.49 - 0.72
- 0.72 - 1

OSM Standard

0   250   500 km

Most Vulnerable Districts

- **Chitral**
- **Bajaur**
- **Mohmand**
- **Orakzai**
- **North Waziristan**
- **Bannu**
- **Tank**
- **South Waziristan**
- **Tharparkar**
- **Qilla Saifullah**
- **Pishin**
- **Karezat**
- **Qilla Abdullah**
- **Loralai**
- **Barkhan**
- **Ziarat**
- **Harnai**
- **Mastung**
- **Kharan**
- **Khuzdar**
- **Nushki**
- **Qalat**
- **Kachhi**
- **Lehri**
- **Jhal Magsi**
- **Chaghi**
- **Washuk**
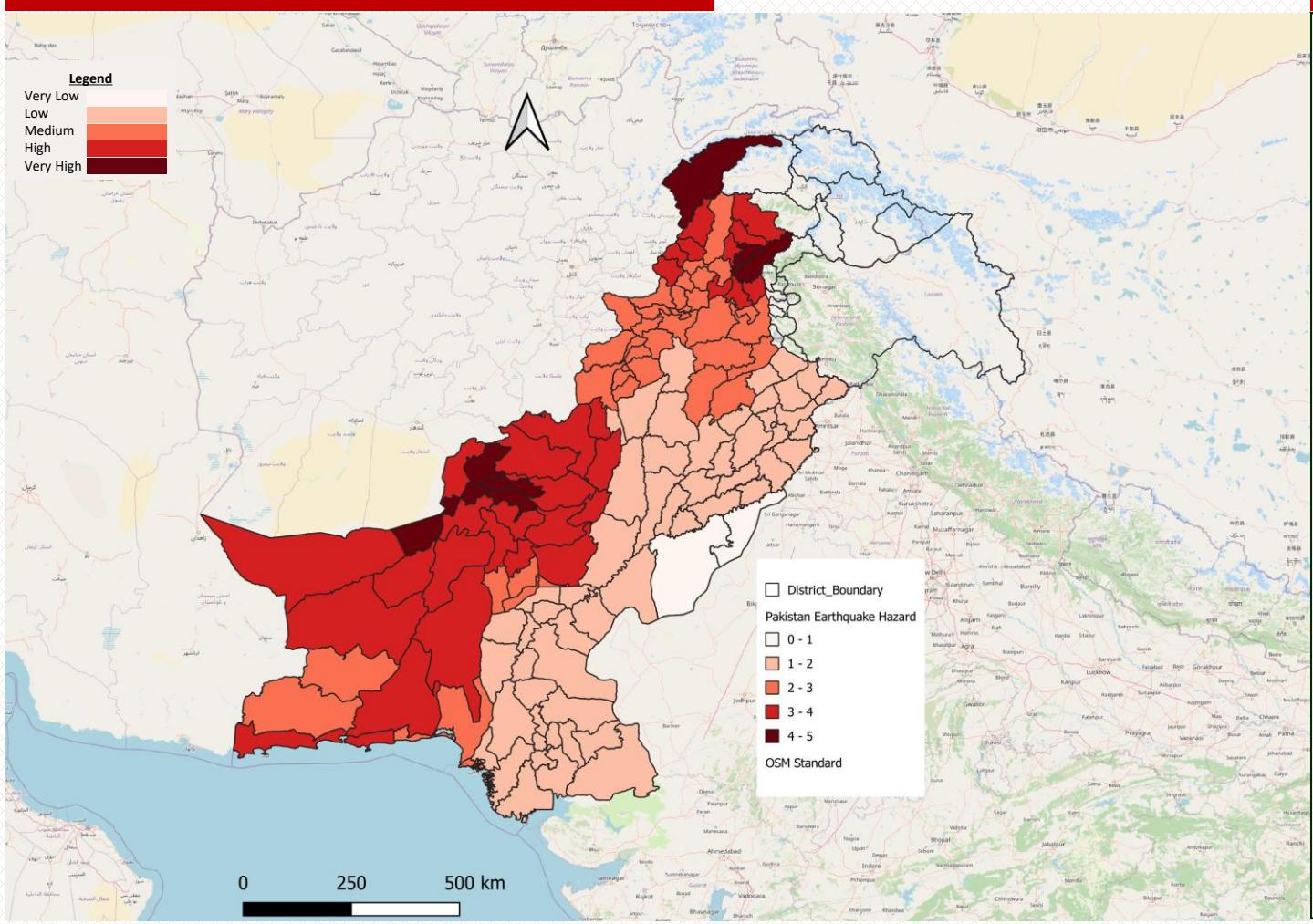
National Maps

Earthquake Hazard

Hazard Map

Most Hazardous Districts

- **Chitral**
- **Batagram**
- **Mansehra**
- **Torghar**
- **Pishin**
- **Quetta**
- **Karezat**
- **Nushki**
- **Ziarat**
- **Harnai**
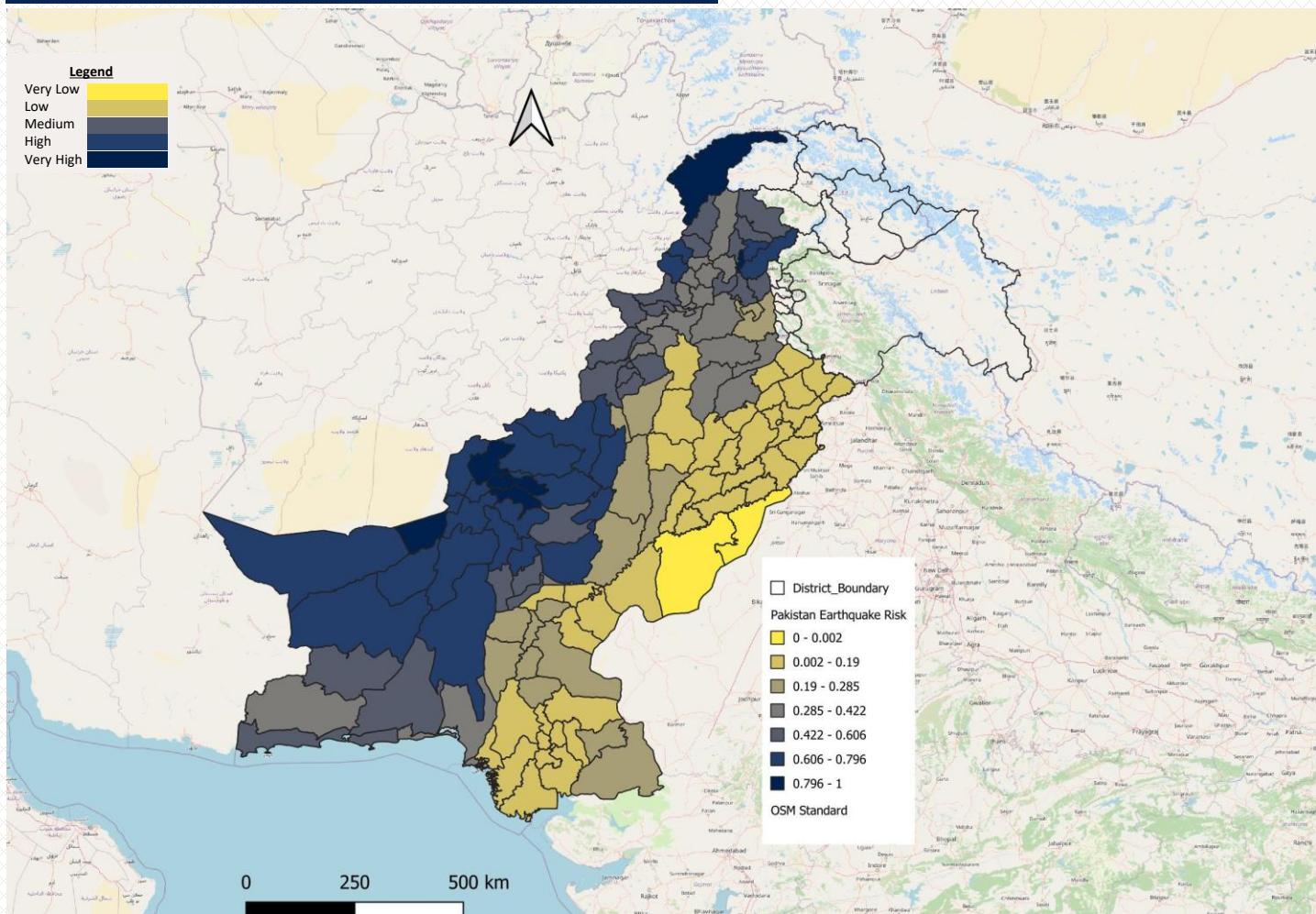
National Maps

Earthquake Hazard

Infrastructure Risk Map
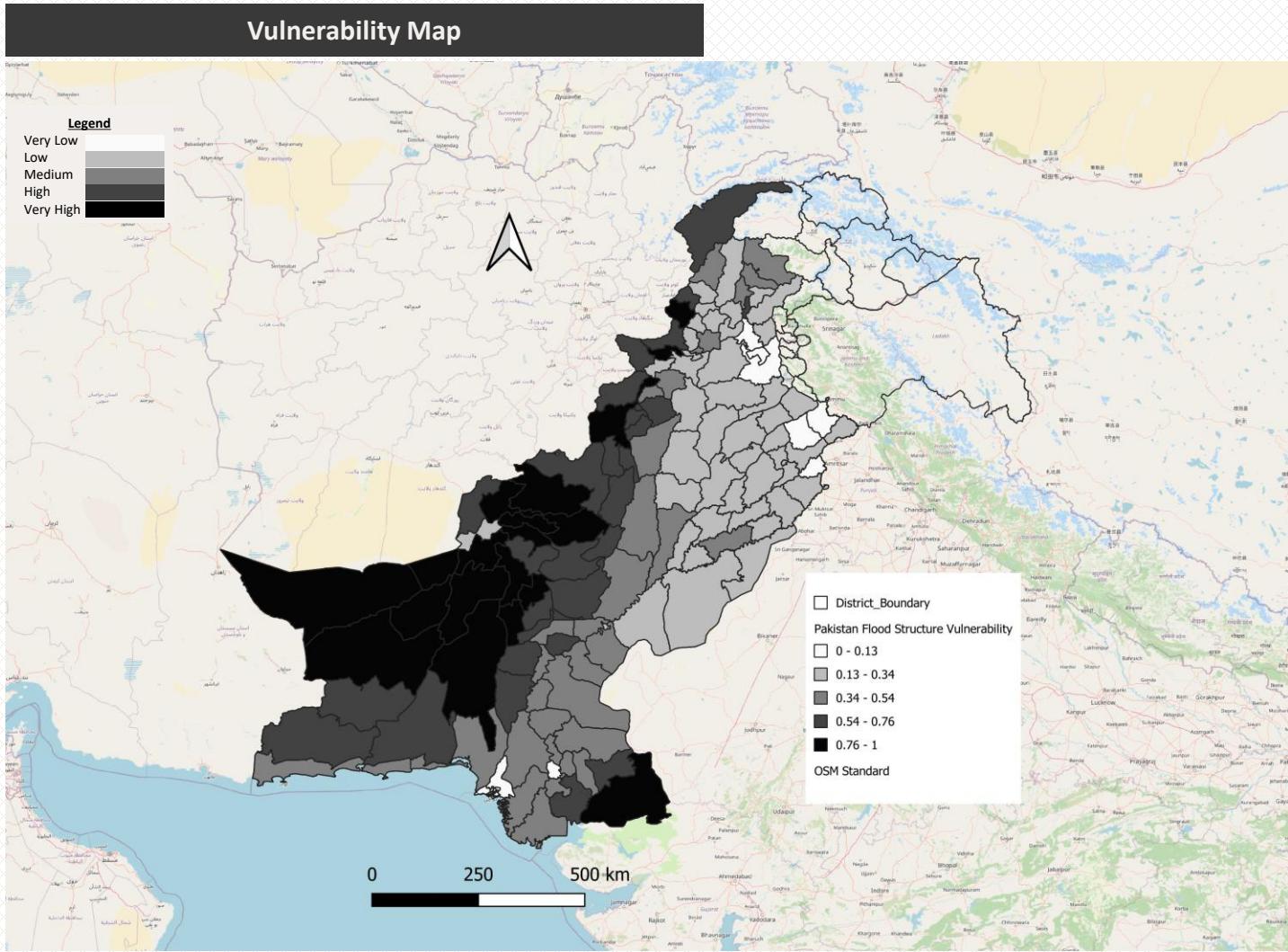
Most at Risk Districts

- Chitral
- Torghar
- Mohmand
- Bajaur
- Mansehra
- Batagram
- Pishin
- Nushki
- Ziarat
- Harnai
- Karezat
- Zhob
- Qillah Saifullah
- Musakhel
- Sherani
- Loralai
- Barkhan
- Qillah Abdullah
- Mastung
- Quetta
- Qalat
- Kachhi
- Sibbi
- Dera Bugti
- Lehri
- Khuzdar
- Kharan
- Washuk
- Chaghi

Legend
- Very Low
- Low
- Medium
- High
- Very High

- District_Boundary

Pakistan Earthquake Risk
- 0 - 0.002
- 0.002 - 0.19
- 0.19 - 0.285
- 0.285 - 0.422
- 0.422 - 0.606
- 0.606 - 0.796
- 0.796 - 1

OSM Standard

0   250   500 km

National Maps

Flood Hazard

Vulnerability Map
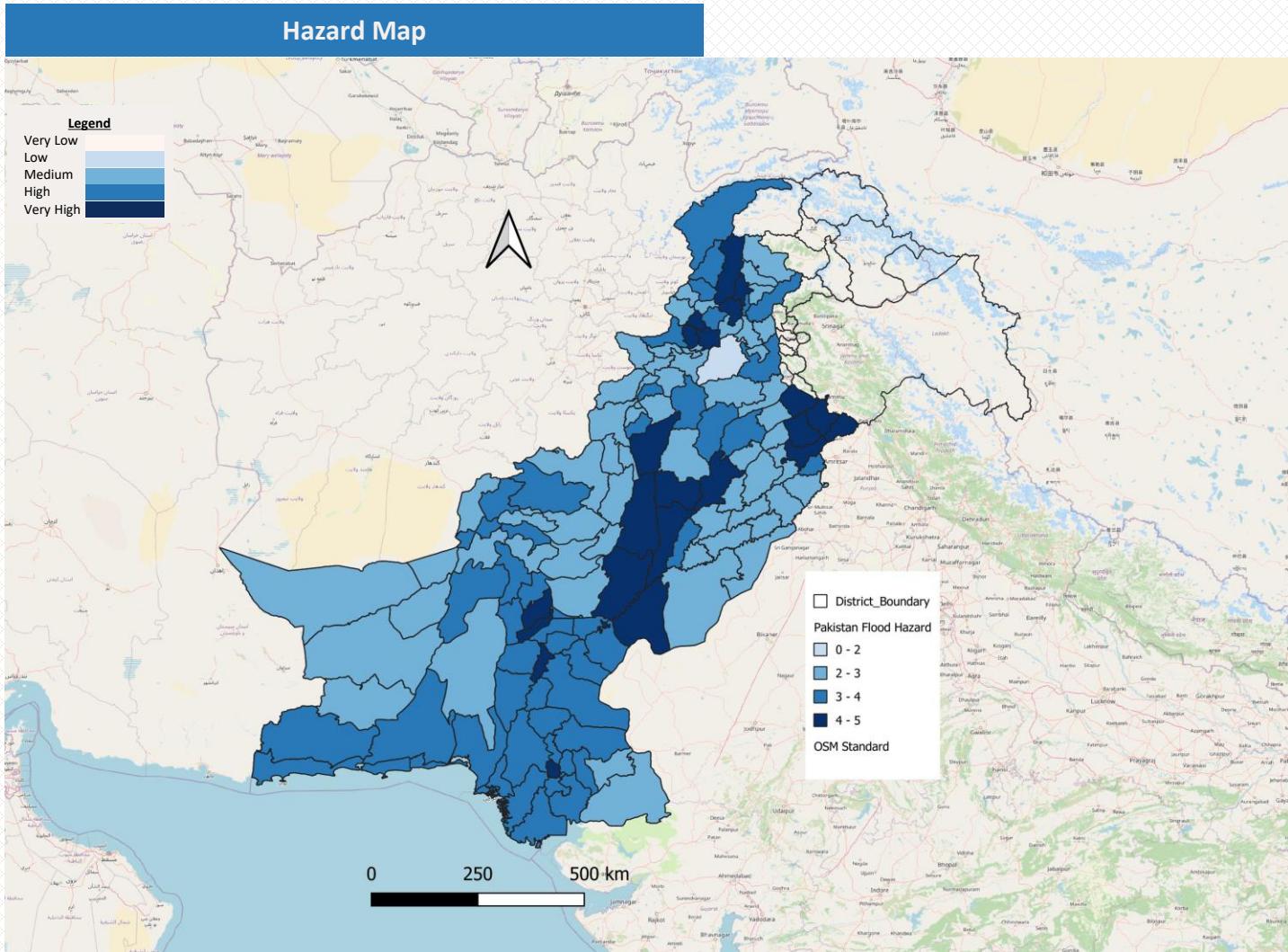
Most Vulnerable Districts

- **Mohmand**
- **Orakzai**
- **South Waziristan**
- **Tharparkar**
- **Qilla Saifullah**
- **Pishin**
- **Karezat**
- **Loralai**
- **Ziarat**
- **Harnai**
- **Mastung**
- **Nushki**
- **Qalat**
- **Lehri**
- **Shaheed Sikandarabad**
- **Kachhi**
- **Jhal Magsi**
- **Khuzdar**
- **Kharan**
- **Chaghi**
- **Washuk**

Legend

Very Low
Low
Medium
High
Very High

District_Boundary

Pakistan Flood Structure Vulnerability

- 0 - 0.13
- 0.13 - 0.34
- 0.34 - 0.54
- 0.54 - 0.76
- 0.76 - 1

OSM Standard

0   250   500 km

National Maps

Flood Hazard

Hazard Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

District_Boundary
Pakistan Flood Hazard
- 0 - 2
- 2 - 3
- 3 - 4
- 4 - 5
OSM Standard

Most Hazardous Districts
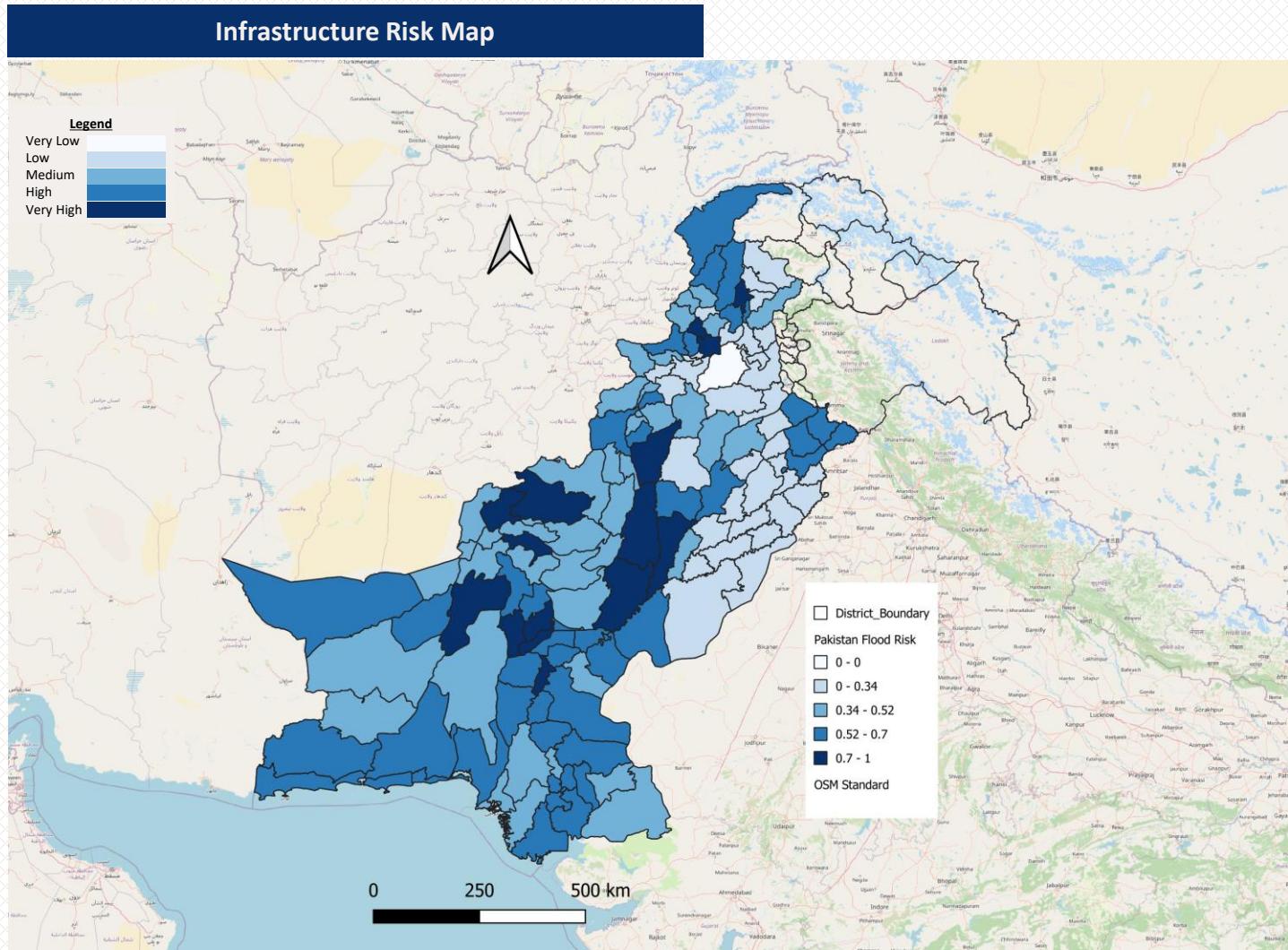
- **Gujrat**
- **Sialkot**
- **Gujranwala**
- **Sheikhupura**
- **Narowal**
- **Wazirabad**
- **Jhang**
- **Layyah**
- **Rahim Yar Khan**
- **Rajanpur**
- **Taunsa**
- **Kot Addu**
- **DG Khan**
- **Muzaffargarh**
- **Charsadda**
- **Shangla**
- **Swat**
- **Buner**
- **DI Khan**
- **Peshawar**
- **Nowshera**
- **Hyderabad**
- **Larkana**
- **Usta Muhammad**
- **Jafarabad**
- **Nasirabad**

National Maps

Flood Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

District_Boundary

Pakistan Flood Risk
- 0 - 0
- 0 - 0.34
- 0.34 - 0.52
- 0.52 - 0.7
- 0.7 - 1

OSM Standard

0   250   500 km

Most at Risk Districts

- **DG Khan**
- **Rajanpur**
- **Muzaffargarh**
- **Taunsa**
- **Kot Addu**
- **Shangla**
- **Charsadda**
- **Nowshera**
- **DI Khan**
- **Larkana**
- **Qilla Saifullah**
- **Karezat**
- **Pishin**
- **Harnai**
- **Qalat**
- **Shaheed Sikandarabad**
- **Jhal Magsi**
- **Nasirabad**
- **Jafarabad**
- **Usta Muhammad**

Provincial Maps

Punjab

Pakistan's most populous and agriculturally rich province, is home to 127 million people and features diverse landscapes, including fertile plains, vast river systems and historical landmarks. The geographical features contribute to the province's agricultural prosperity and also expose its infrastructure to various risks.

Punjab faces significant hazards such as flooding, especially during the monsoon season. Its reliance on river-based irrigation makes it vulnerable to embankment breaches, riverbank erosion and flash floods, which can severely damage homes, roads, bridges and irrigation systems. Additionally, the northern region is prone to earthquakes due to its proximity to the Himalayan seismic zone, further threatening infrastructure stability.

Rapid urbanization in cities like Lahore, Faisalabad and Multan has also strained infrastructure, increasing vulnerability to system failures in transportation, sewage and energy networks, particularly during extreme weather events. The Infrastructure Risk Atlas aims to provide a detailed understanding of these risks, focusing on earthquakes and floods, and assesses the resilience of Punjab's residential infrastructure at the district level against these two major hazards.
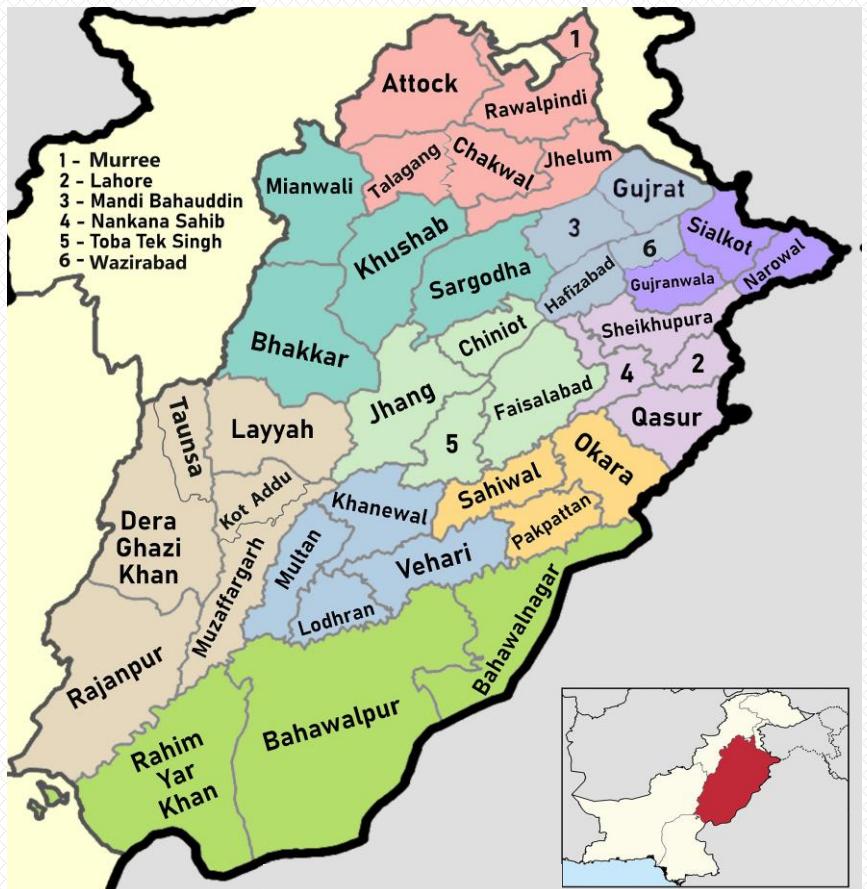
Figure 2: *District Map of Punjab Province*
Source: *Wikipedia*
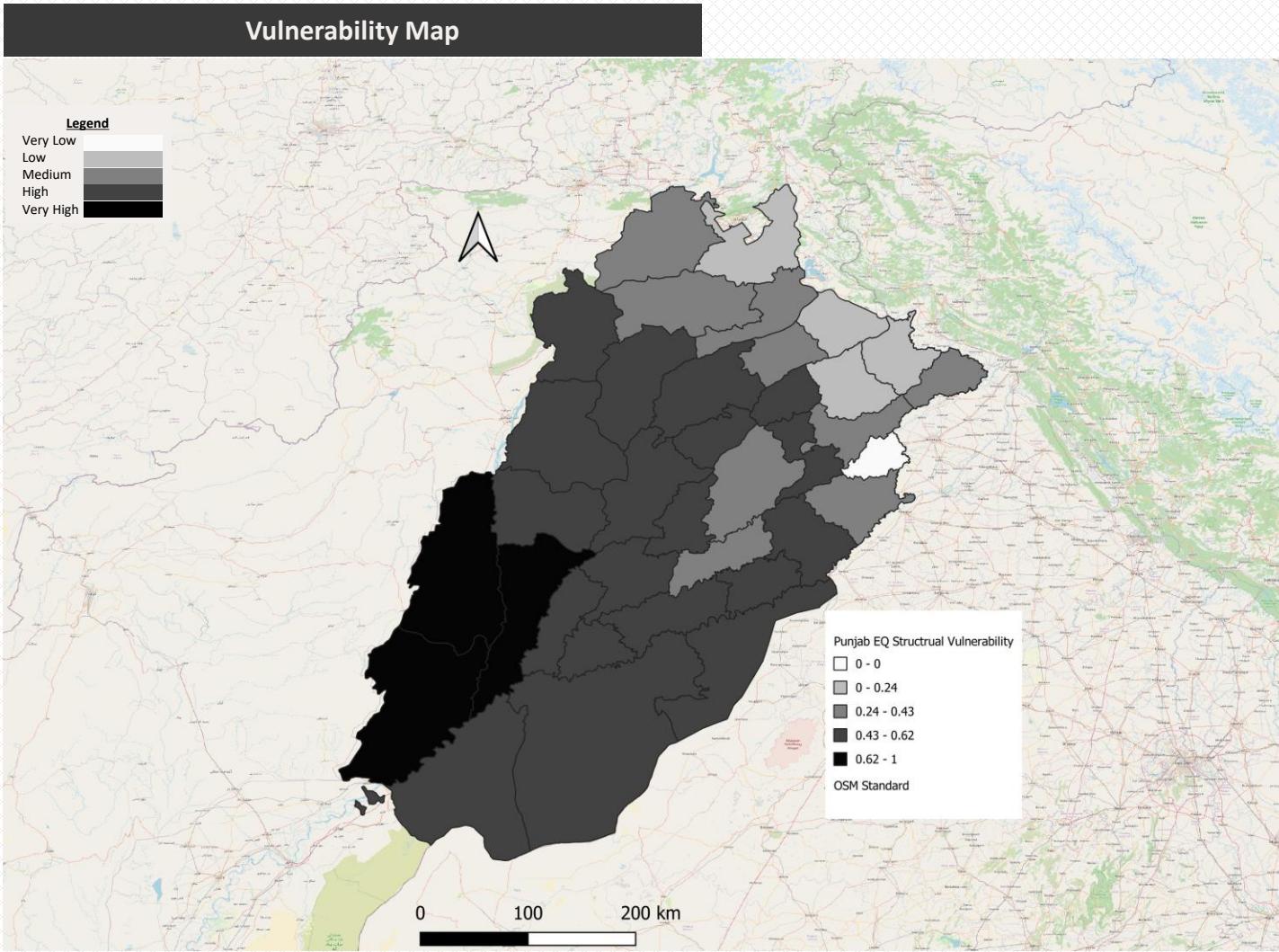
Provincial Maps – Punjab

Earthquake Hazard

Vulnerability Map

Most Vulnerable Districts

- **DG Khan**
- **Rajanpur**
- **Muzaffargarh**
- **Kot Addu**
- **Taunsa**
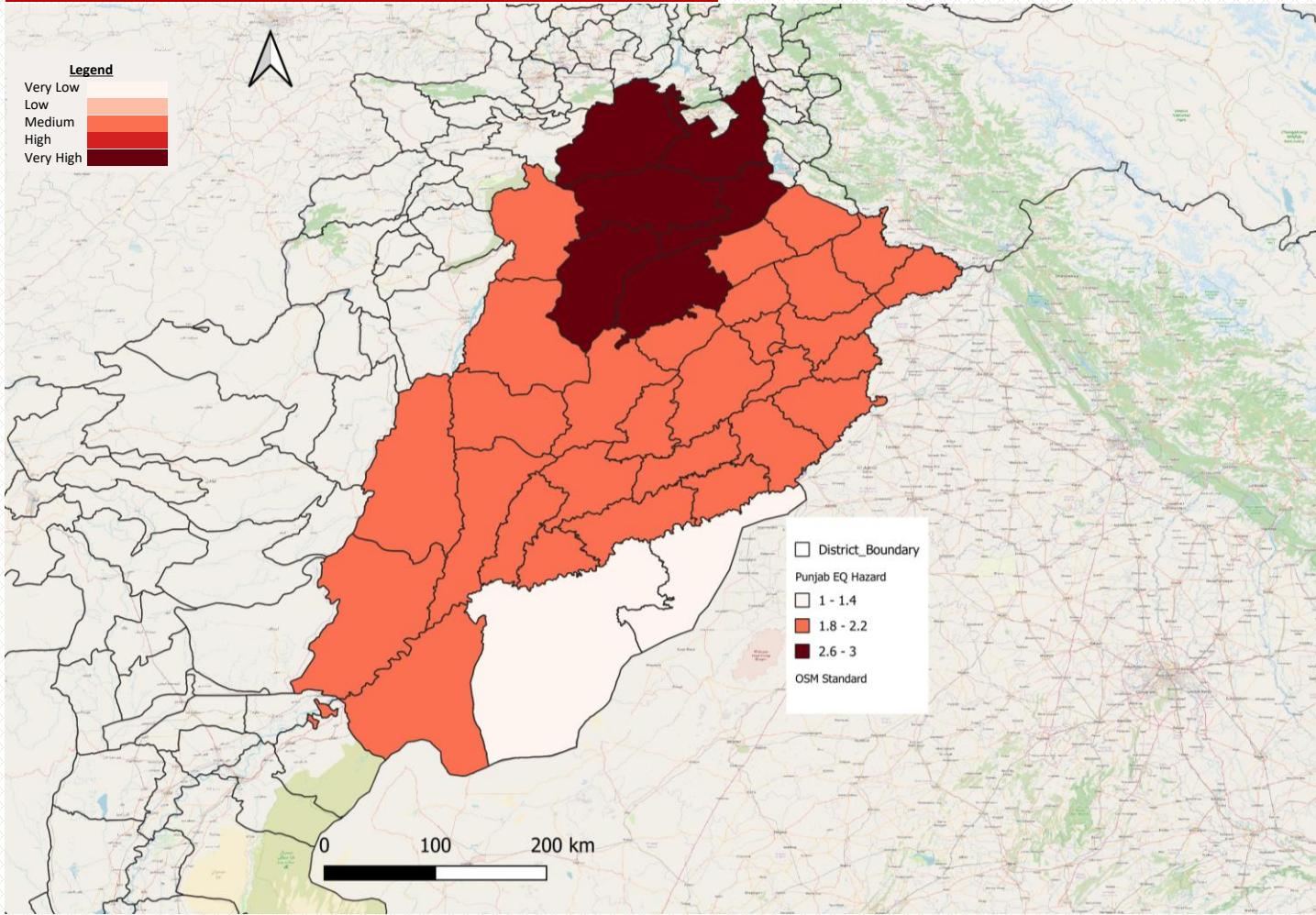
Legend
Very Low
Low
Medium
High
Very High

Punjab EQ Structrual Vulnerability
0 - 0
0 - 0.24
0.24 - 0.43
0.43 - 0.62
0.62 - 1

OSM Standard

0   100   200 km

Provincial Maps – Punjab

Earthquake Hazard

Hazard Map

Most Hazardous Districts
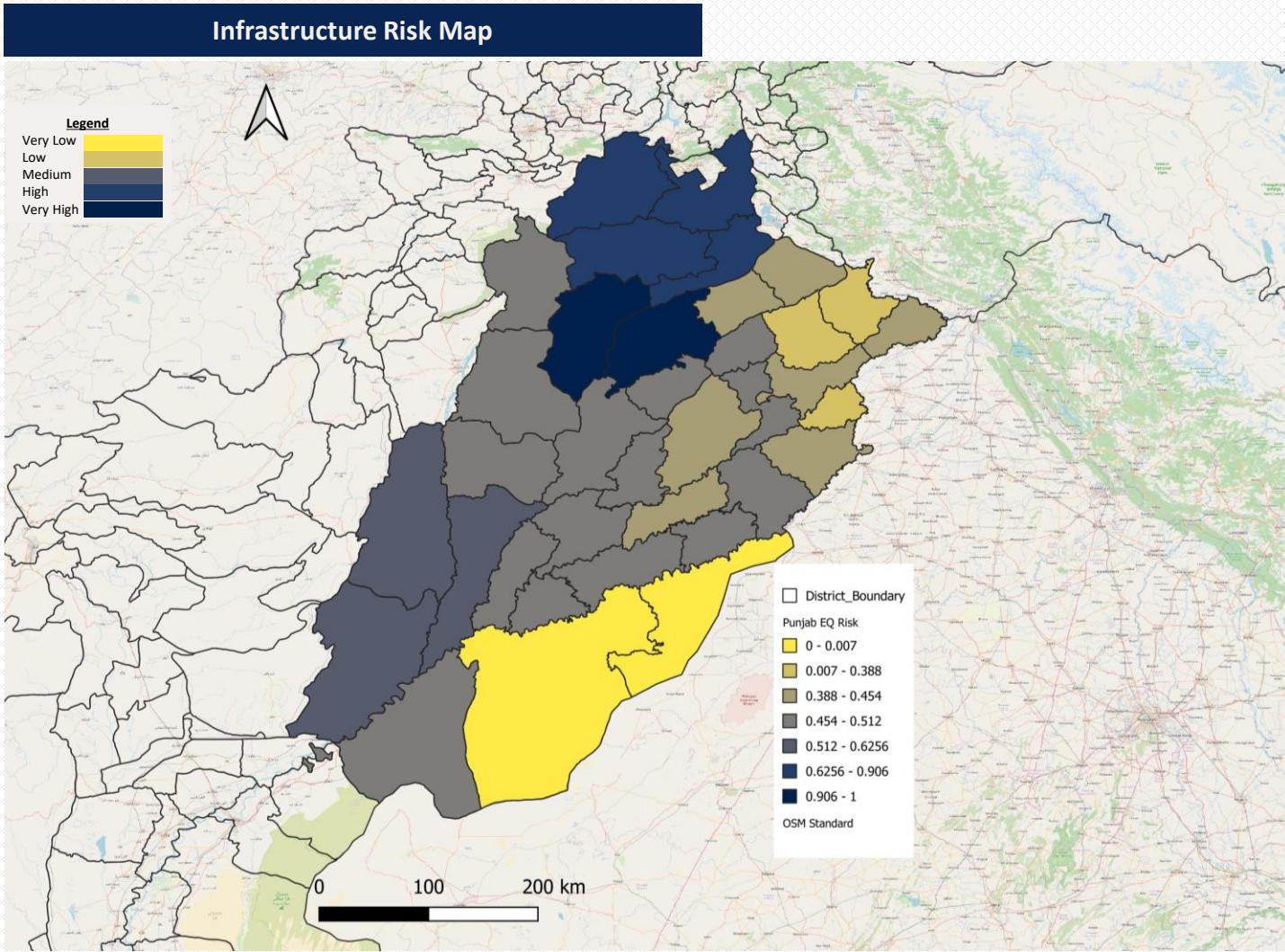
- **Rawalpindi**
- **Attock**
- **Murree**
- **Jhelum**
- **Chakwal**
- **Khushab**
- **Sargodha**

Legend
Very Low
Low
Medium
High
Very High

District_Boundary

Punjab EQ Hazard
1 - 1.4
1.8 - 2.2
2.6 - 3

OSM Standard

0   100   200 km

Provincial Maps – Punjab

Earthquake Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

District_Boundary

Punjab EQ Risk
- 0 - 0.007
- 0.007 - 0.388
- 0.388 - 0.454
- 0.454 - 0.512
- 0.512 - 0.6256
- 0.6256 - 0.906
- 0.906 - 1

OSM Standard

0   100   200 km

Most at Risk Districts

- **Khushab** **(Very High)**
- **Sargodha** **(Very High)**
- **Rawalpindi** **(High)**
- **Murree** **(High)**
- **Attock** **(High)**
- **Jhelum** **(High)**
- **Chakwal** **(High)**
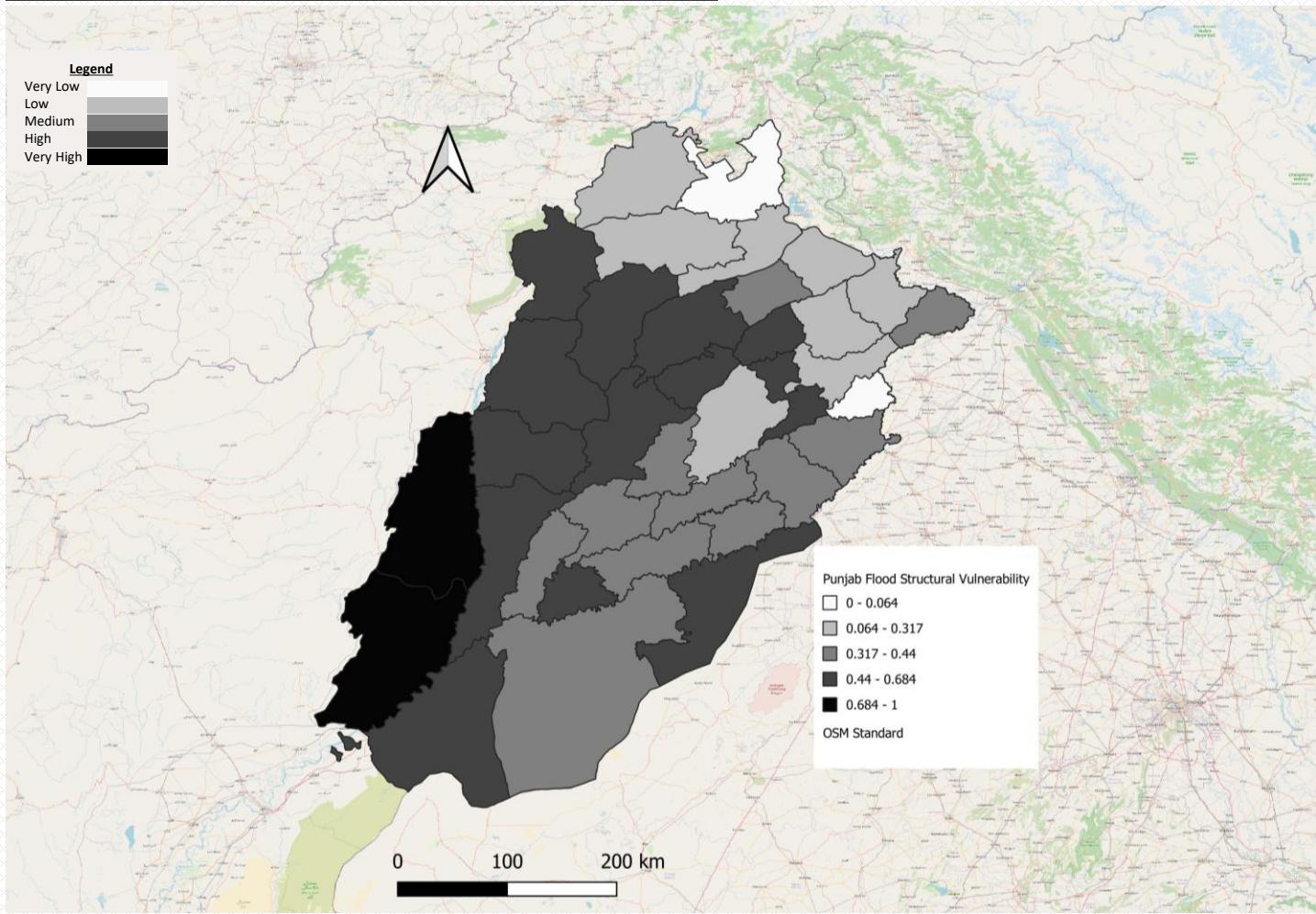
Provincial Maps – Punjab

Flood Hazard

Vulnerability Map

Most Vulnerable Districts

- **DG Khan**
- **Rajanpur**
- **Taunsa**

Legend
Very Low
Low
Medium
High
Very High

Punjab Flood Structural Vulnerability

- 0 - 0.064
- 0.064 - 0.317
- 0.317 - 0.44
- 0.44 - 0.684
- 0.684 - 1

OSM Standard

0   100   200 km

Provincial Maps – Punjab

Flood Hazard

Hazard Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

Punjab Flood Hazard
- 0 - 2
- 2 - 3
- 3 - 4
- 4 - 5

OSM Standard

0   100   200 km
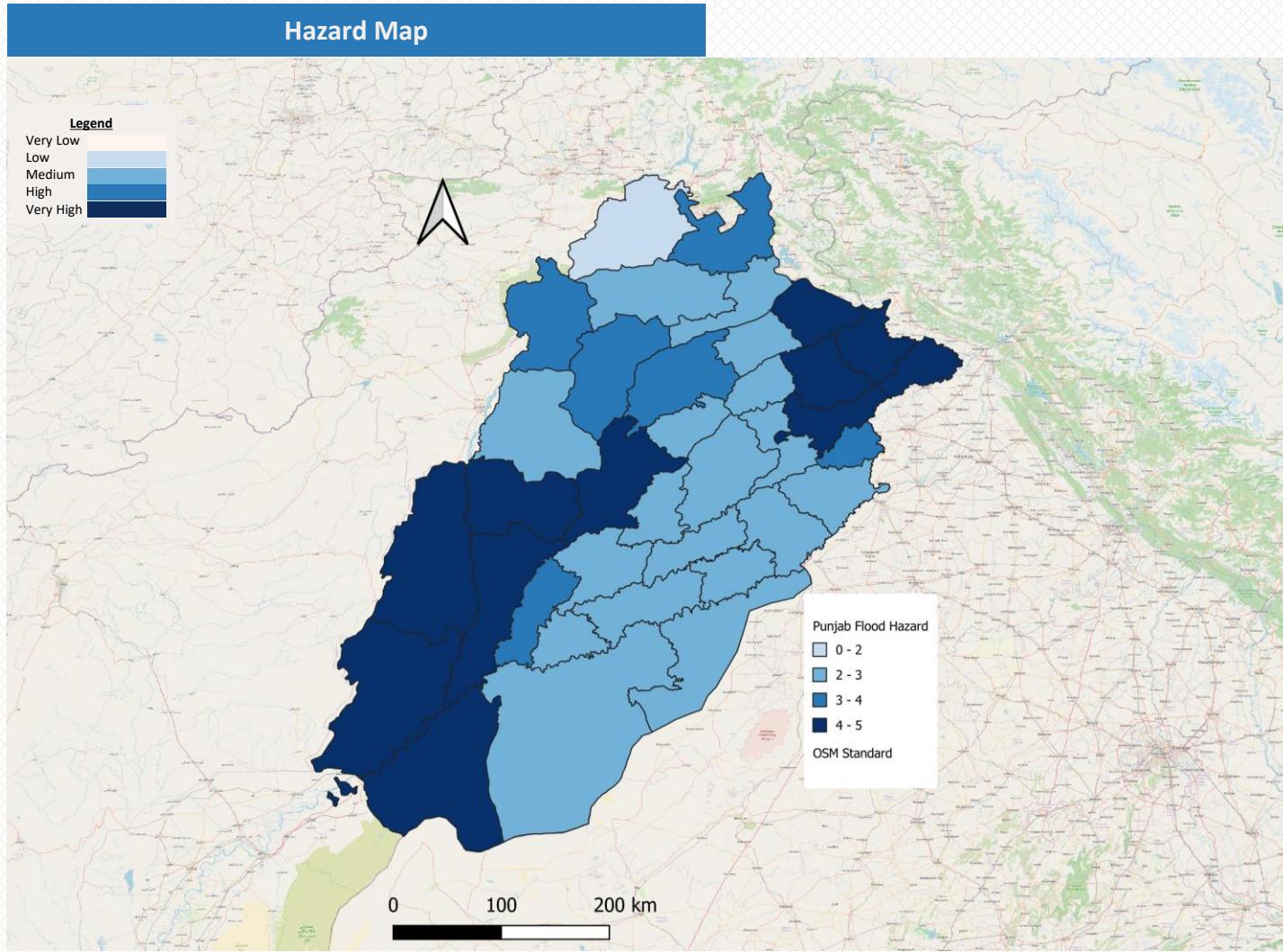
Most Hazardous Districts
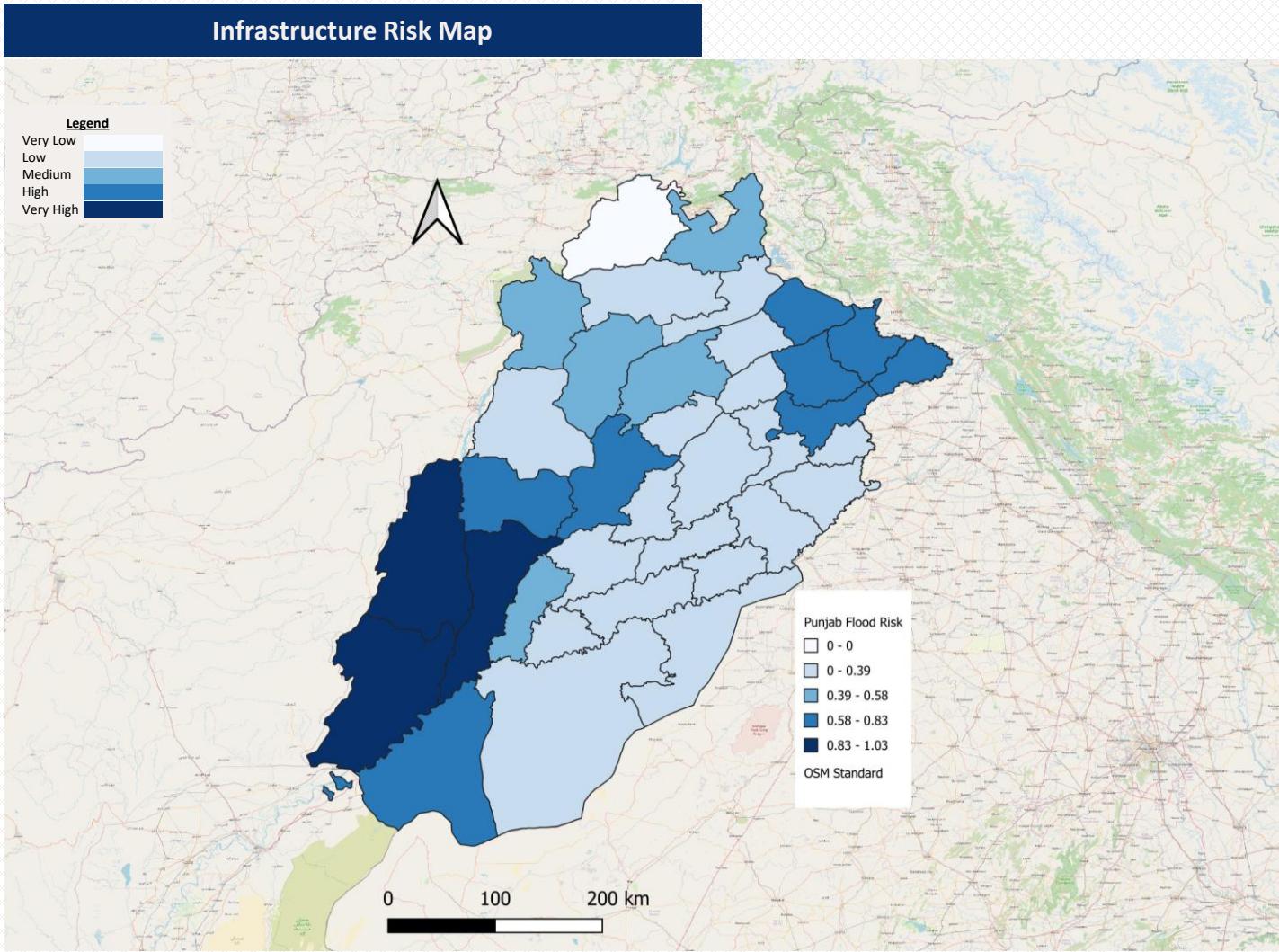
- **DG Khan**
- **Rajanpur**
- **Rahim Yar Khan**
- **Muzaffargarh**
- **Taunsa**
- **Layyah**
- **Kot Addu**
- **Jhang**
- **Gujrat**
- **Wazirabad**
- **Gujranwala**
- **Sialkot**
- **Narowal**
- **Sheikhupura**

Provincial Maps – Punjab

Flood Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

Punjab Flood Risk
- 0 - 0
- 0 - 0.39
- 0.39 - 0.58
- 0.58 - 0.83
- 0.83 - 1.03

OSM Standard

0   100   200 km

Most at Risk Districts

District	Risk
DG Khan	(Very High)
Rajanpur	(Very High)
Muzaffargarh	(Very High)
Kot Addu	(Very High)
Taunsa	(Very High)
Gujrat	(High)
Wazirabad	(High)
Gujranwala	(High)
Sheikhupura	(High)
Narowal	(High)
Sialkot	(High)
Jhang	(High)
Layyah	(High)
Rahim Yar Khan	(High)

Provincial Maps

Khyber Pakhtunkhwa

Khyber Pakhtunkhwa located in northwest Pakistan, is a region of dramatic landscapes, from the towering Hindu Kush Mountain range to the fertile plains of the River Kabul. The geographical features make the province vulnerable to a variety of natural hazards that impact its infrastructure.

KP lies on the edge of the seismically active Himalayan region, making it prone to earthquakes that have historically caused significant damage to buildings, roads and bridges. The province also faces riverine flooding, particularly along the Kabul, Swat and Indus rivers, worsened by monsoon rains. Flash floods and overflow from rivers often disrupt transportation, agriculture and infrastructure, causing widespread damage. The mountainous terrain and inadequate drainage systems further heighten these risks.

Additionally, rapid urbanization in cities like Peshawar, Abbottabad and Mardan has overloaded infrastructure, including sewage and water supply systems, exacerbating vulnerability to system failures, particularly during extreme weather events. The atlas aims to provide a detailed understanding of these risks, focusing on earthquakes and floods and assesses the resilience of KP's residential infrastructure at the district level against these hazards.

Figure 3: *District Map of Khyber Pakhtunkhwa Province*
Source: *Wikipedia*
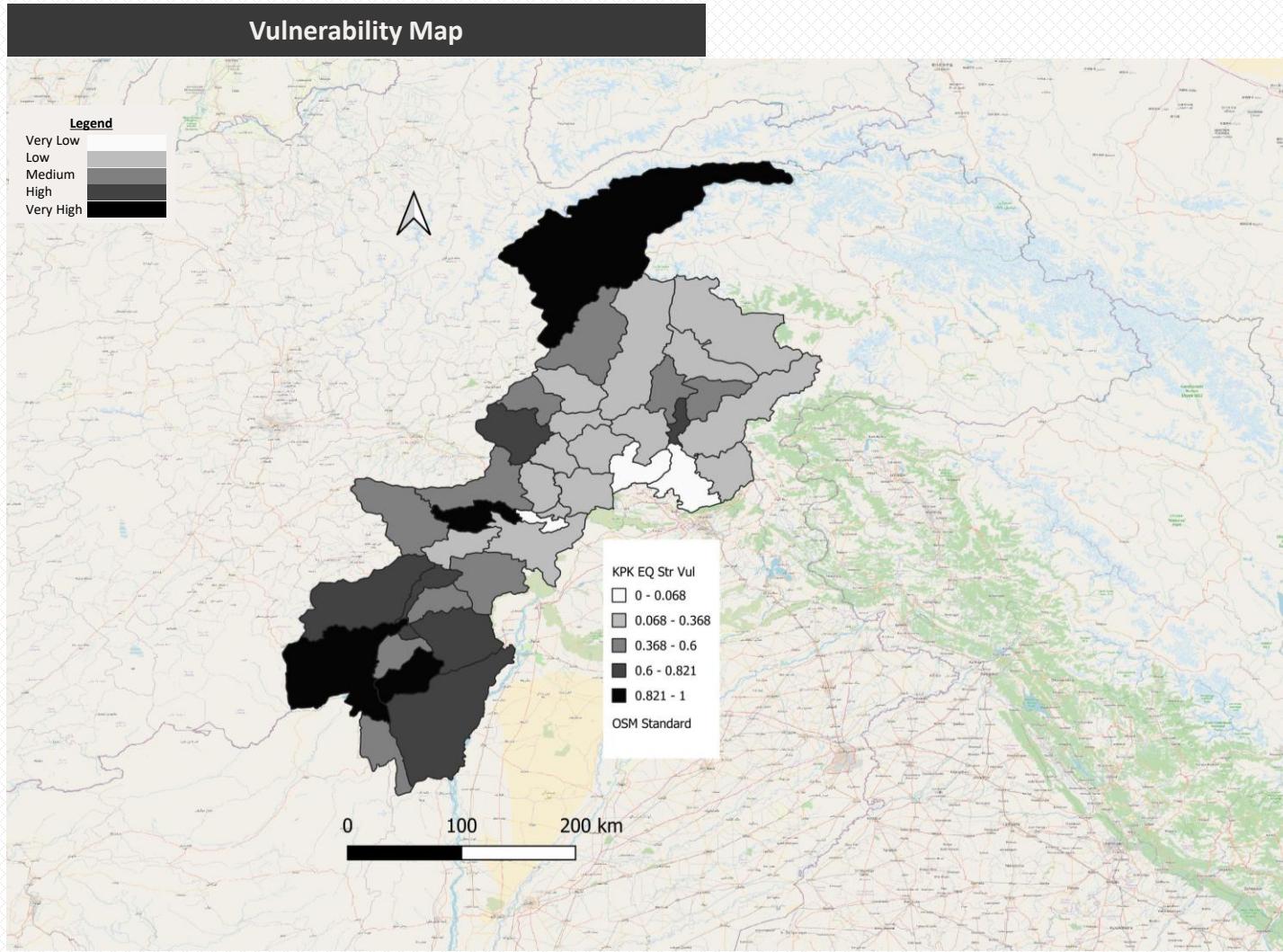
Provincial Maps – Khyber Pakhtunkhwa

Earthquake Hazard

Vulnerability Map

Legend
Very Low
Low
Medium
High
Very High

KPK EQ Str Vul
0 - 0.068
0.068 - 0.368
0.368 - 0.6
0.6 - 0.821
0.821 - 1

OSM Standard

0   100   200 km

Most Vulnerable Districts

- **Chitral**
- **Orakzai**
- **Tank**
- **South Waziristan**
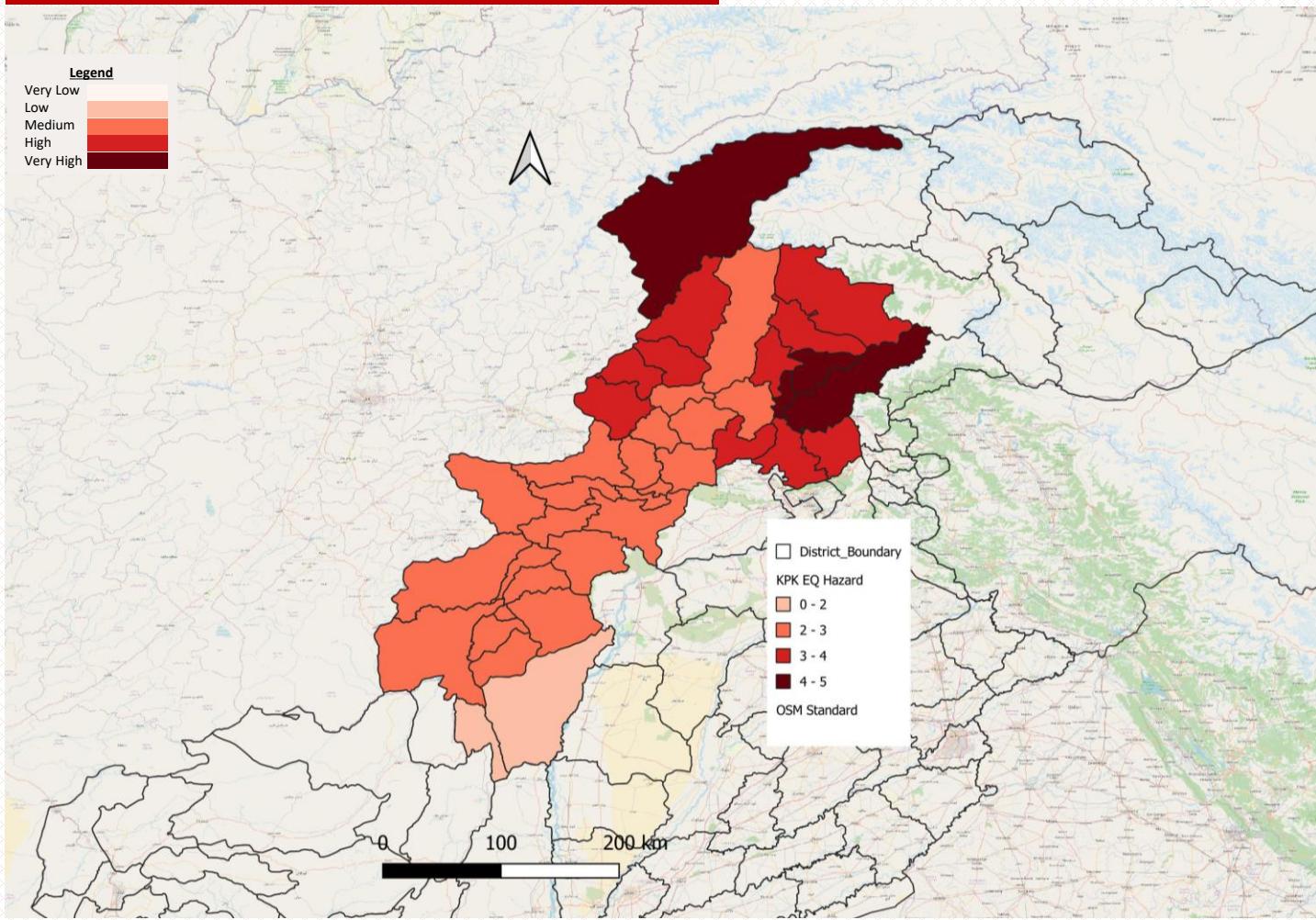
Provincial Maps – Khyber Pakhtunkhwa

Earthquake Hazard

Hazard Map

Most Hazardous Districts

Legend
Very Low
Low
Medium
High
Very High

District_Boundary

KPK EQ Hazard
0 - 2
2 - 3
3 - 4
4 - 5

OSM Standard

0   100   200 km
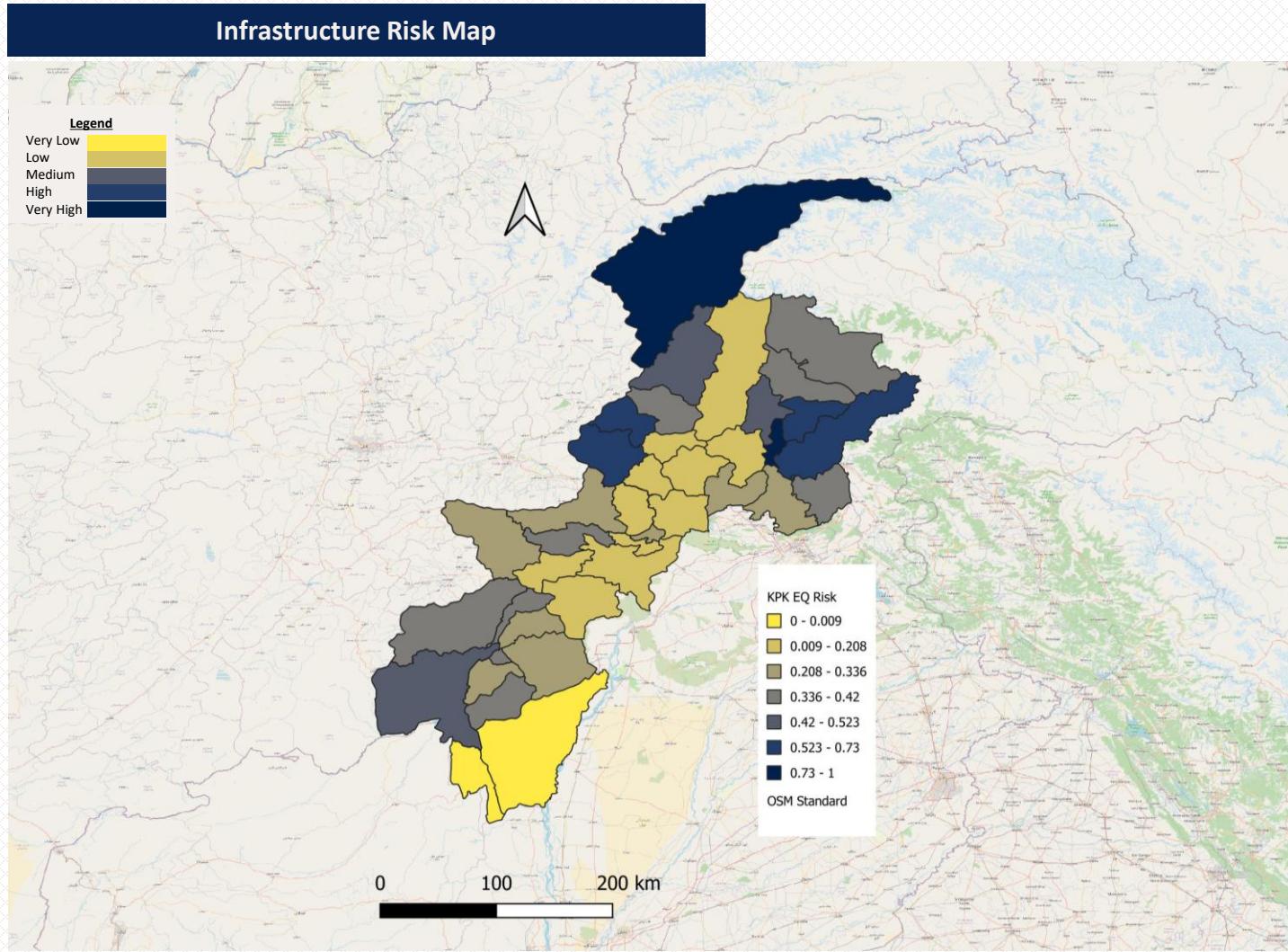
- **Chitral**
- **Mansehra**
- **Batagram**
- **Torghar**

Provincial Maps – Khyber Pakhtunkhwa

Earthquake Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

KPK EQ Risk
- 0 - 0.009
- 0.009 - 0.208
- 0.208 - 0.336
- 0.336 - 0.42
- 0.42 - 0.523
- 0.523 - 0.73
- 0.73 - 1

OSM Standard

0   100   200 km
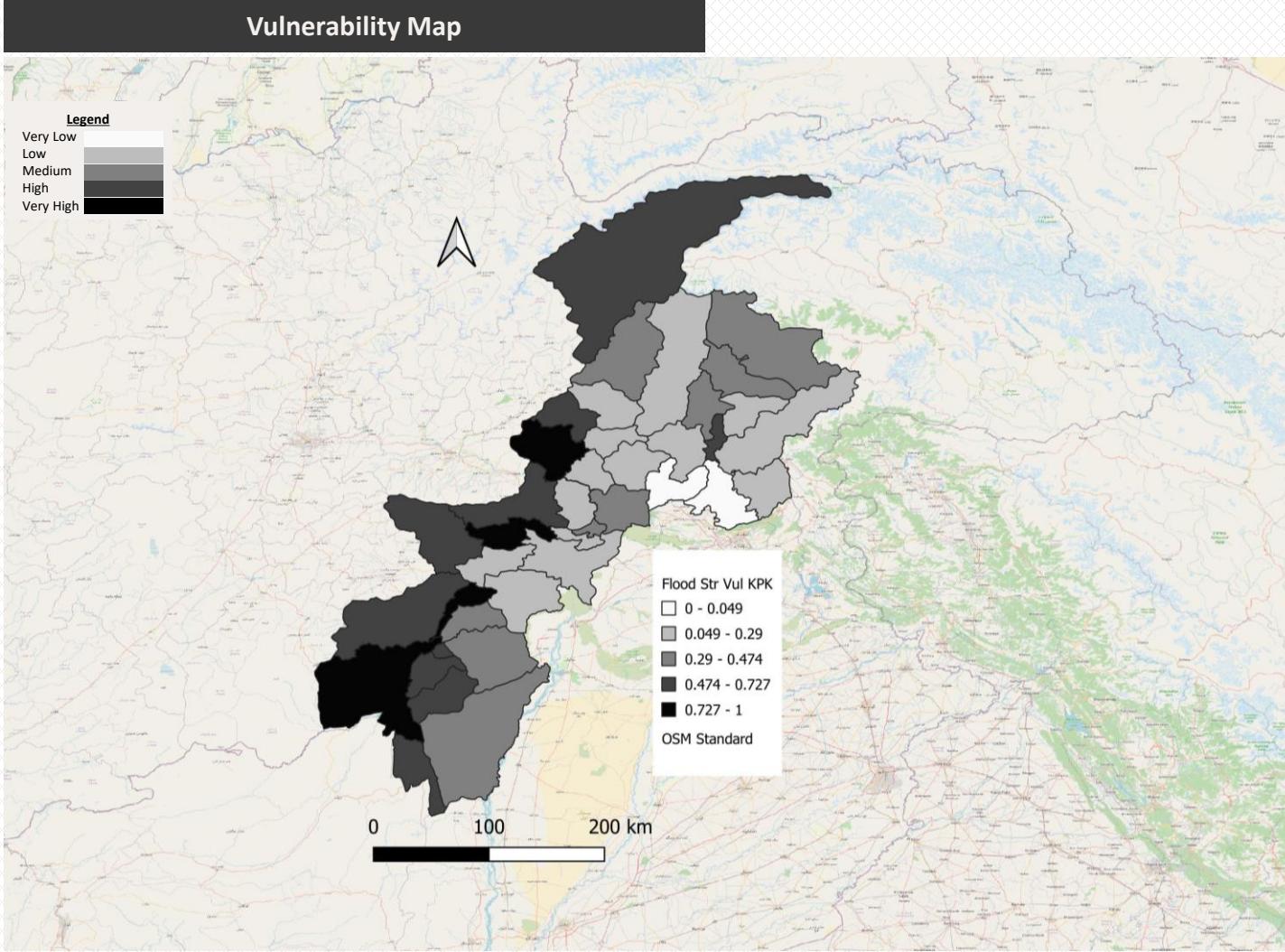
Most at Risk Districts

- **Chitral** (Very High)
- **Torghar** (Very High)
- **Bajaur** (High)
- **Mohmand** (High)
- **Mansehra** (High)
- **Batagram** (High)

Provincial Maps – Khyber Pakhtunkhwa

Flood Hazard

Vulnerability Map

Most Vulnerable Districts

- **South Waziristan**
- **Bannu**
- **Orakzai**
- **Mohmand**
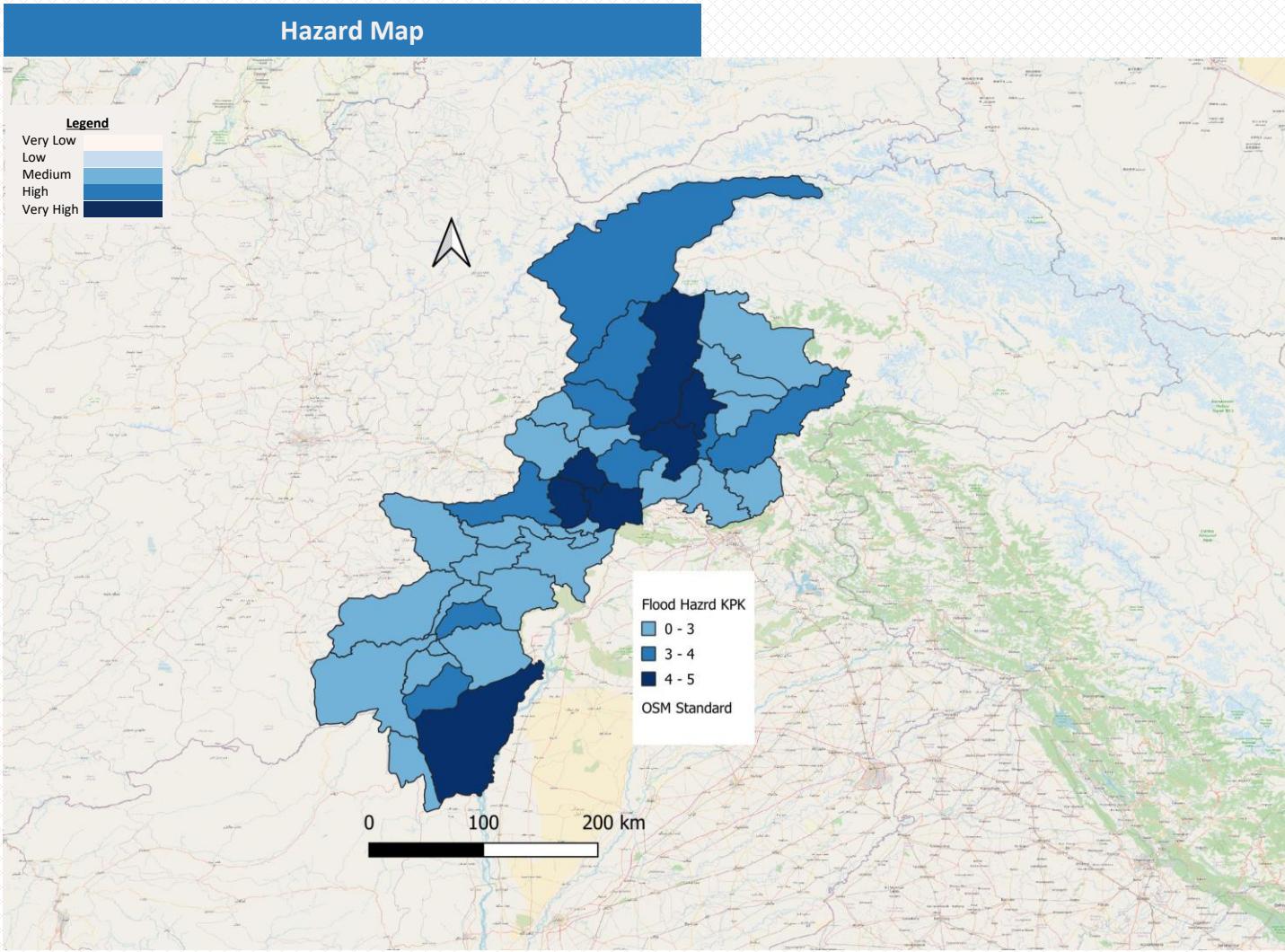
Legend
Very Low
Low
Medium
High
Very High

Flood Str Vul KPK
- 0 - 0.049
- 0.049 - 0.29
- 0.29 - 0.474
- 0.474 - 0.727
- 0.727 - 1

OSM Standard

0   100   200 km

Provincial Maps – Khyber Pakhtunkhwa

Flood Hazard

Hazard Map

Legend
Very Low
Low
Medium
High
Very High

Flood Hazrd KPK
0 - 3
3 - 4
4 - 5

OSM Standard

0   100   200 km

Most Hazardous Districts

- **Swat**
- **Shangla**
- **Buner**
- **Charsadda**
- **Peshawar**
- **Nowshera**
- **DI Khan**
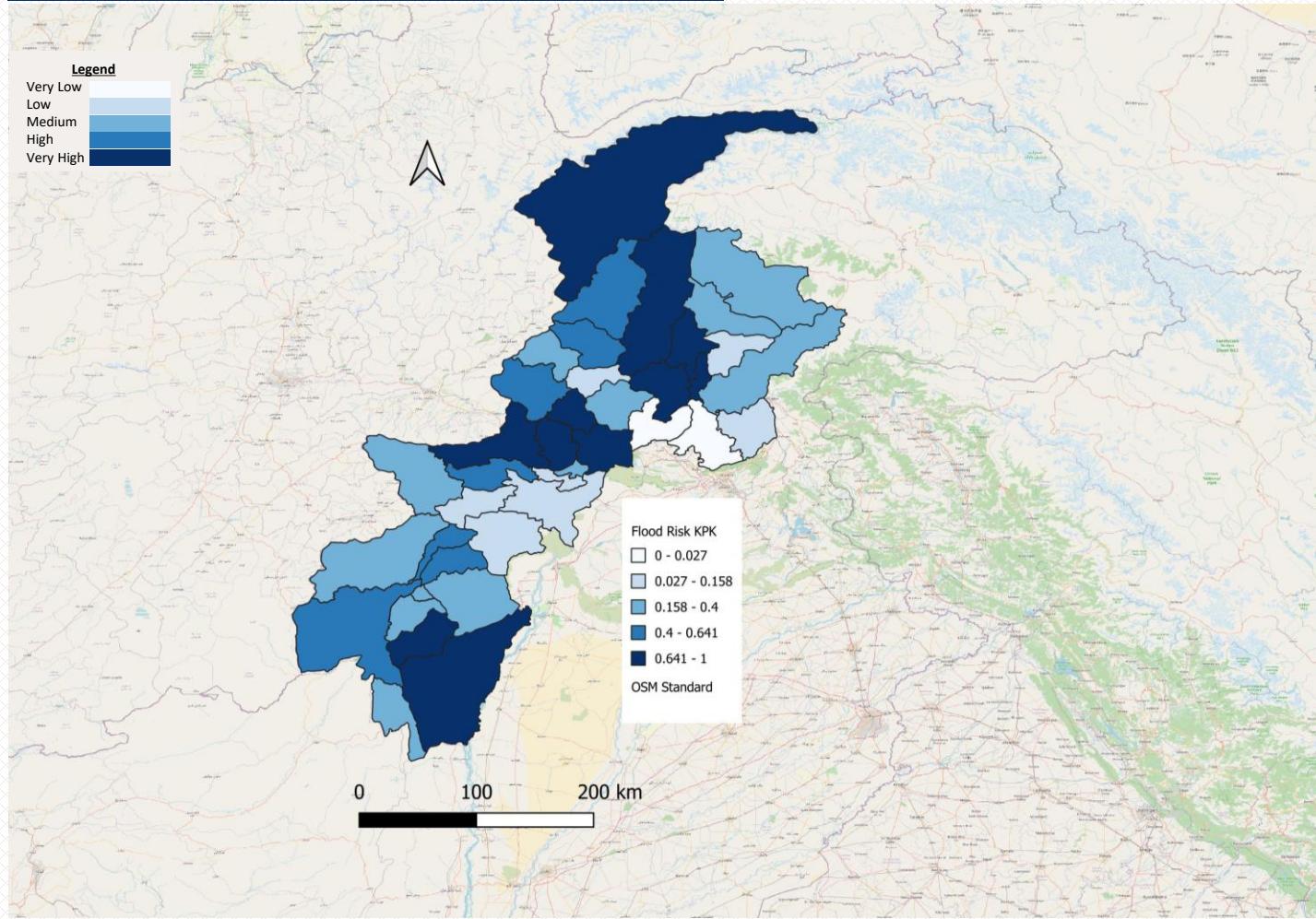
Provincial Maps – Khyber Pakhtunkhwa

Flood Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

Flood Risk KPK
- 0 – 0.027
- 0.027 – 0.158
- 0.158 – 0.4
- 0.4 – 0.641
- 0.641 – 1

OSM Standard

0   100   200 km

Most at Risk Districts

• **Chitral**	**(Very High)**
• **Swat**	**(Very High)**
• **Shangla**	**(Very High)**
• **Buner**	**(Very High)**
• **Torghar**	**(Very High)**
• **Khyber**	**(Very High)**
• **Peshawar**	**(Very High)**
• **Charsadda**	**(Very High)**
• **Nowshera**	**(Very High)**
• **DI Khan**	**(Very High)**
• **Tank**	**(Very High)**

Provincial Maps   Sindh

Sindh located in south-eastern Pakistan, is a region known for its rich culture, thriving economy and diverse landscapes, which influence its infrastructure needs and risks. The province features expansive alluvial plains, semi-arid regions and coastal areas along the Arabian Sea, with the Indus River playing a vital role in agriculture and irrigation.

Sindh faces significant infrastructure risks, particularly from flooding during the monsoon season and the overflow of the Indus River. These floods regularly damage roads, bridges and irrigation systems, with inadequate urban drainage, especially in Karachi, exacerbating the impact. The province's hot summers, with temperatures often exceeding 40°C, stress infrastructure such as energy networks and transportation systems, increasing vulnerability to climate-induced challenges.

Although less seismic than other regions of Pakistan, Sindh is prone to low-magnitude earthquakes, which can damage buildings and utilities. Rapid urbanization in cities like Karachi has led to congestion and strained infrastructure, worsening the risks of system failures during extreme weather events. The atlas provides an overview of Sindh's residential infrastructure and its vulnerability to hazards.
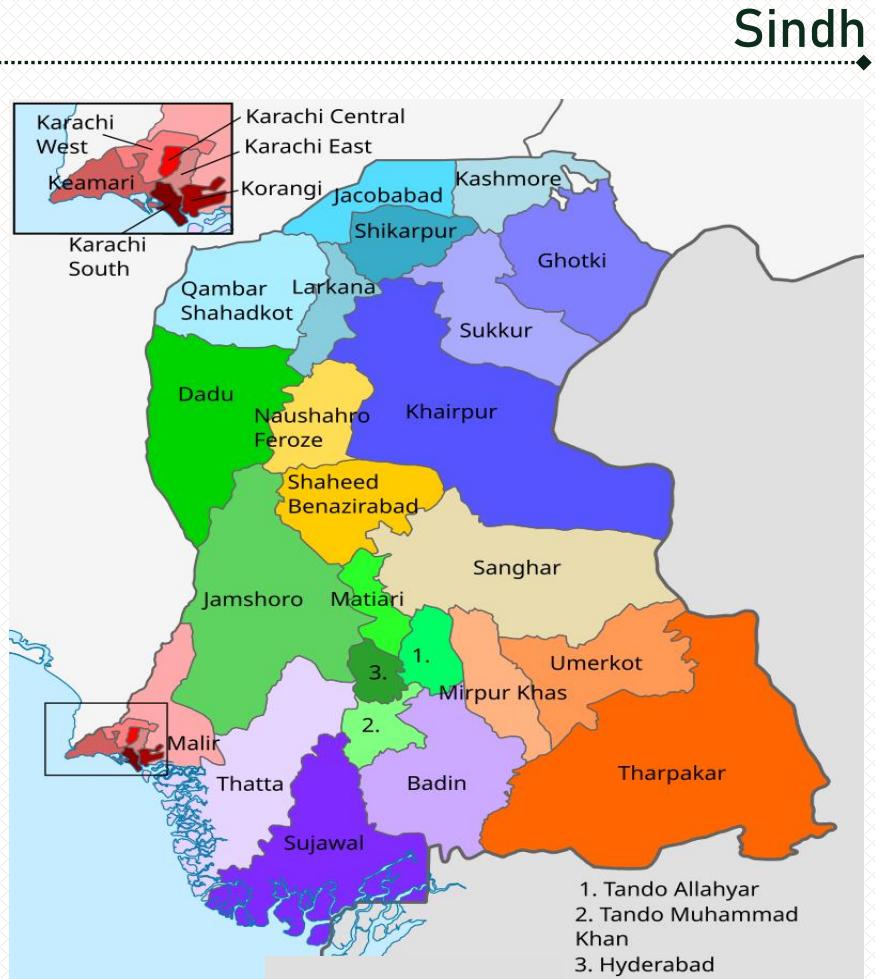
Figure 4: *District Map of Sindh Province*
Source: *Wikipedia*
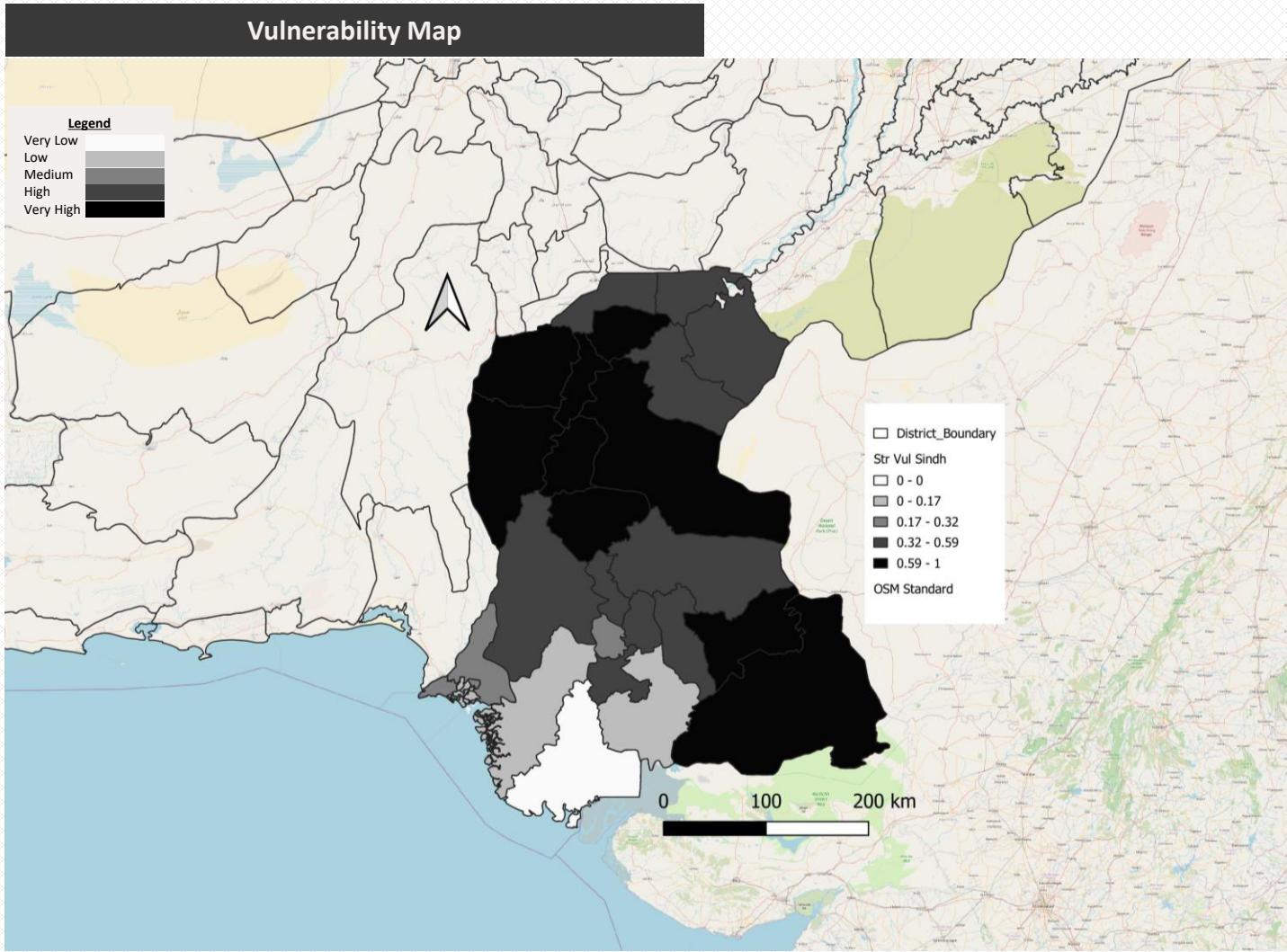
Provincial Maps – Sindh

Earthquake Hazard

Vulnerability Map

Most Vulnerable Districts
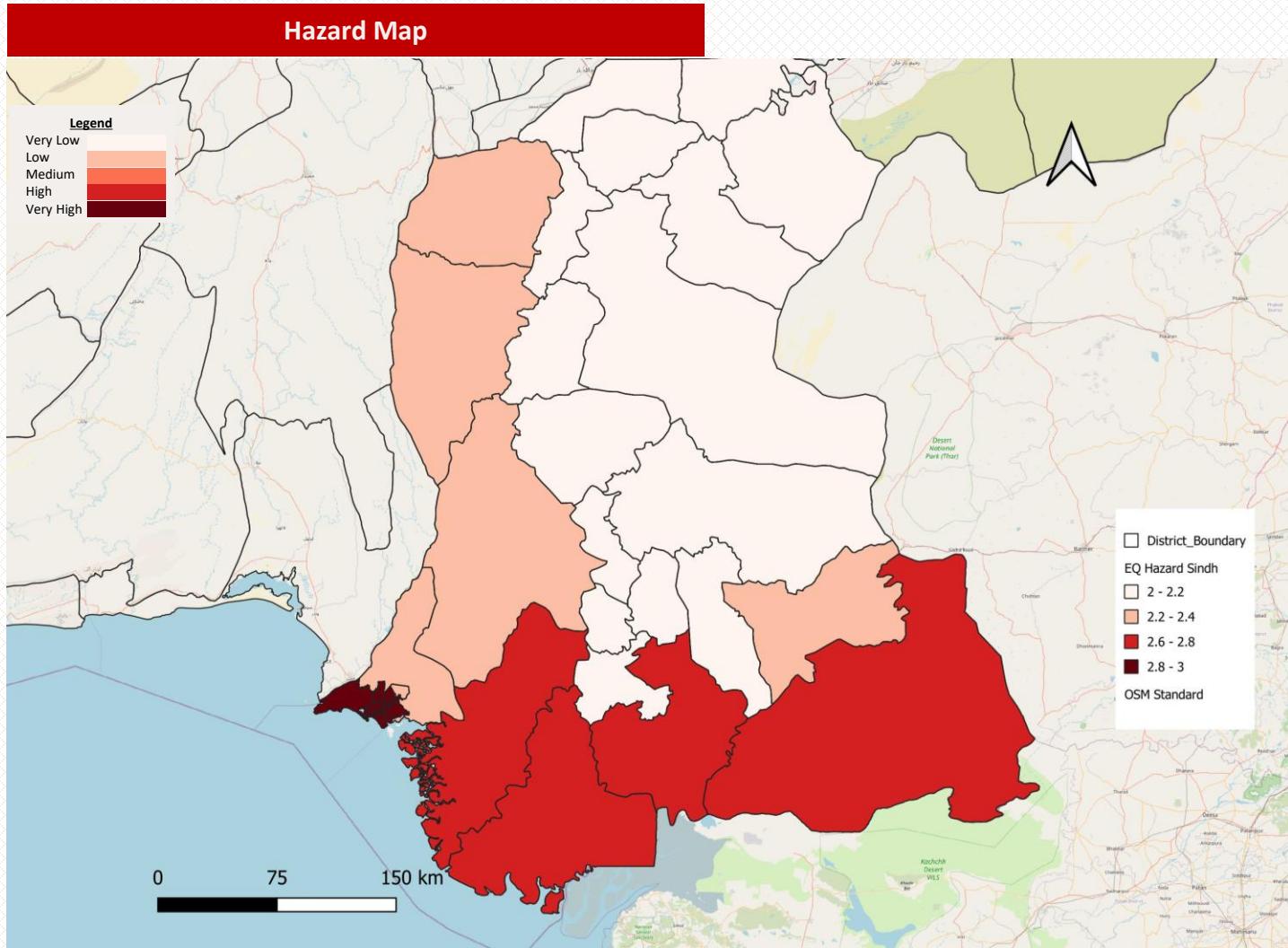
- **Tharparkar**
- **Umer Kot**
- **Khairpur**
- **Shaheed Benazirabad**
- **Naushahro Feroz**
- **Dadu**
- **Shahdadkot**
- **Larkana**
- **Shikarpur**

Legend
Very Low
Low
Medium
High
Very High

District_Boundary
Str Vul Sindh
0 - 0
0 - 0.17
0.17 - 0.32
0.32 - 0.59
0.59 - 1
OSM Standard

0   100   200 km

Provincial Maps – Sindh

Earthquake Hazard

Hazard Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

District_Boundary

EQ Hazard Sindh
- 2 - 2.2
- 2.2 - 2.4
- 2.6 - 2.8
- 2.8 - 3

OSM Standard

0   75   150 km

Most Hazardous Districts
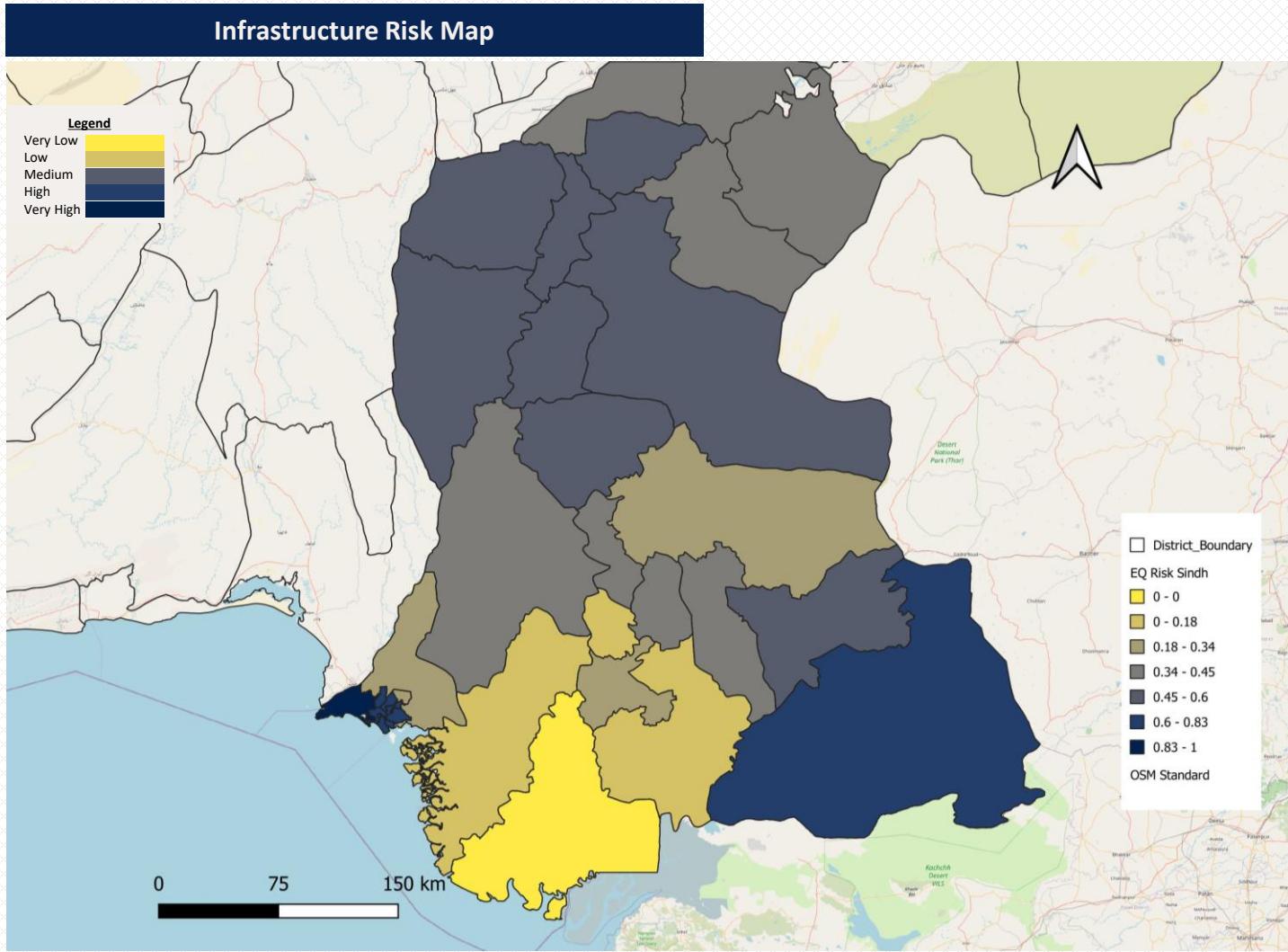
- **Tharparkar**
- **Sujawal**
- **Badin**
- **Thatta**
- **Karachi**

Provincial Maps – Sindh

Earthquake Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

District_Boundary

EQ Risk Sindh
- 0 - 0
- 0 - 0.18
- 0.18 - 0.34
- 0.34 - 0.45
- 0.45 - 0.6
- 0.6 - 0.83
- 0.83 - 1

OSM Standard

0   75   150 km

Most at Risk Districts

- **Karachi**   (Very High)
- **Tharpakar**   (High)

Provincial Maps – Sindh

Flood Hazard

Vulnerability Map

Most Vulnerable Districts

Legend
Very Low
Low
Medium
High
Very High

Flood Vul Sindh
- 0 - 0.024
- 0.024 - 0.13
- 0.13 - 0.546
- 0.546 - 0.726
- 0.726 - 1

OSM Standard

0   100   200 km

- **Tharparkar**

Provincial Maps – Sindh

Flood Hazard

Hazard Map

Legend
Very Low
Low
Medium
High
Very High

Flood Hazard Sindh
2 - 3
3 - 4
4 - 5
OSM Standard

0   100   200 km
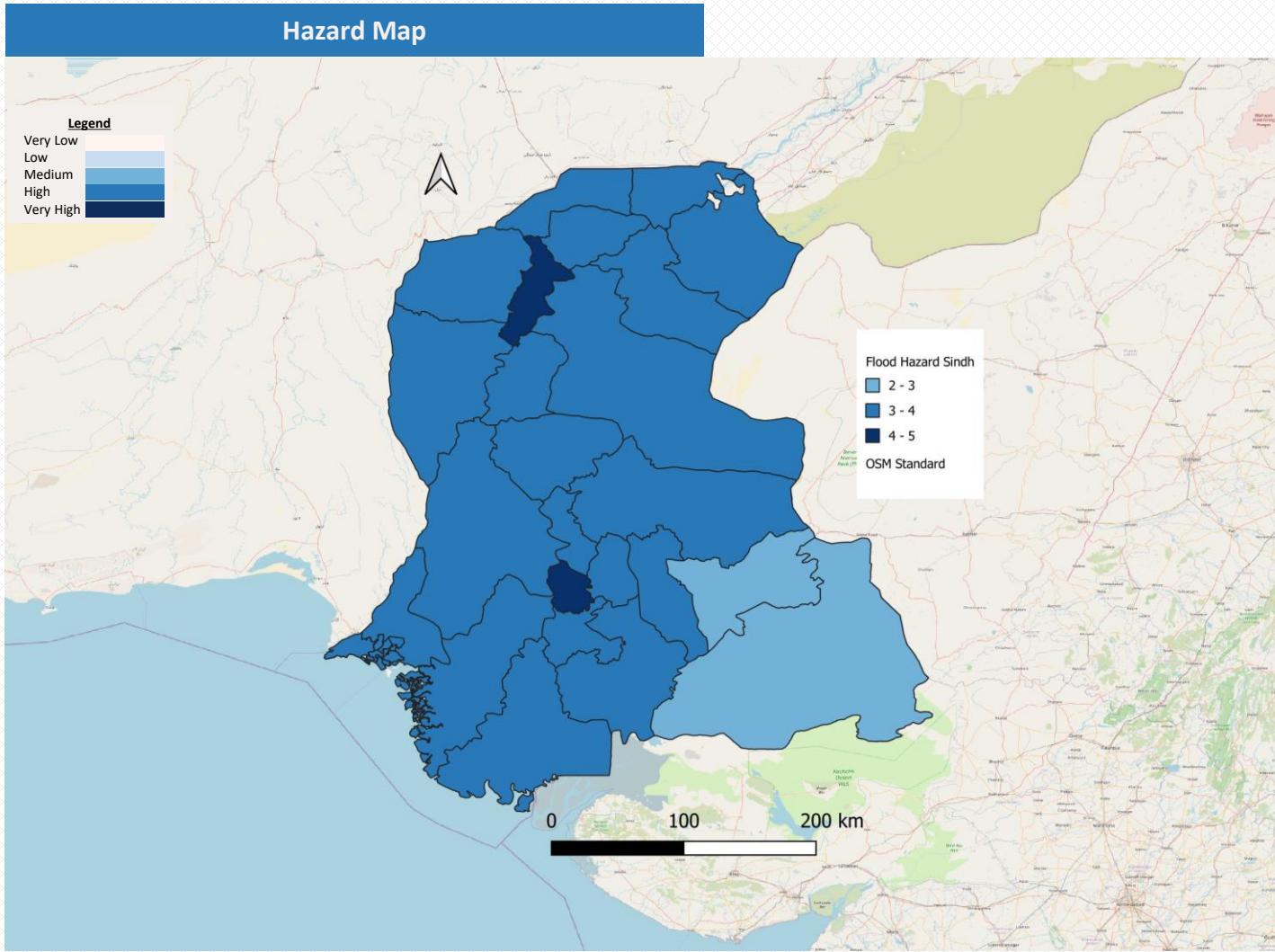
Most Hazardous Districts

- **Larkana**
- **Hyderabad**
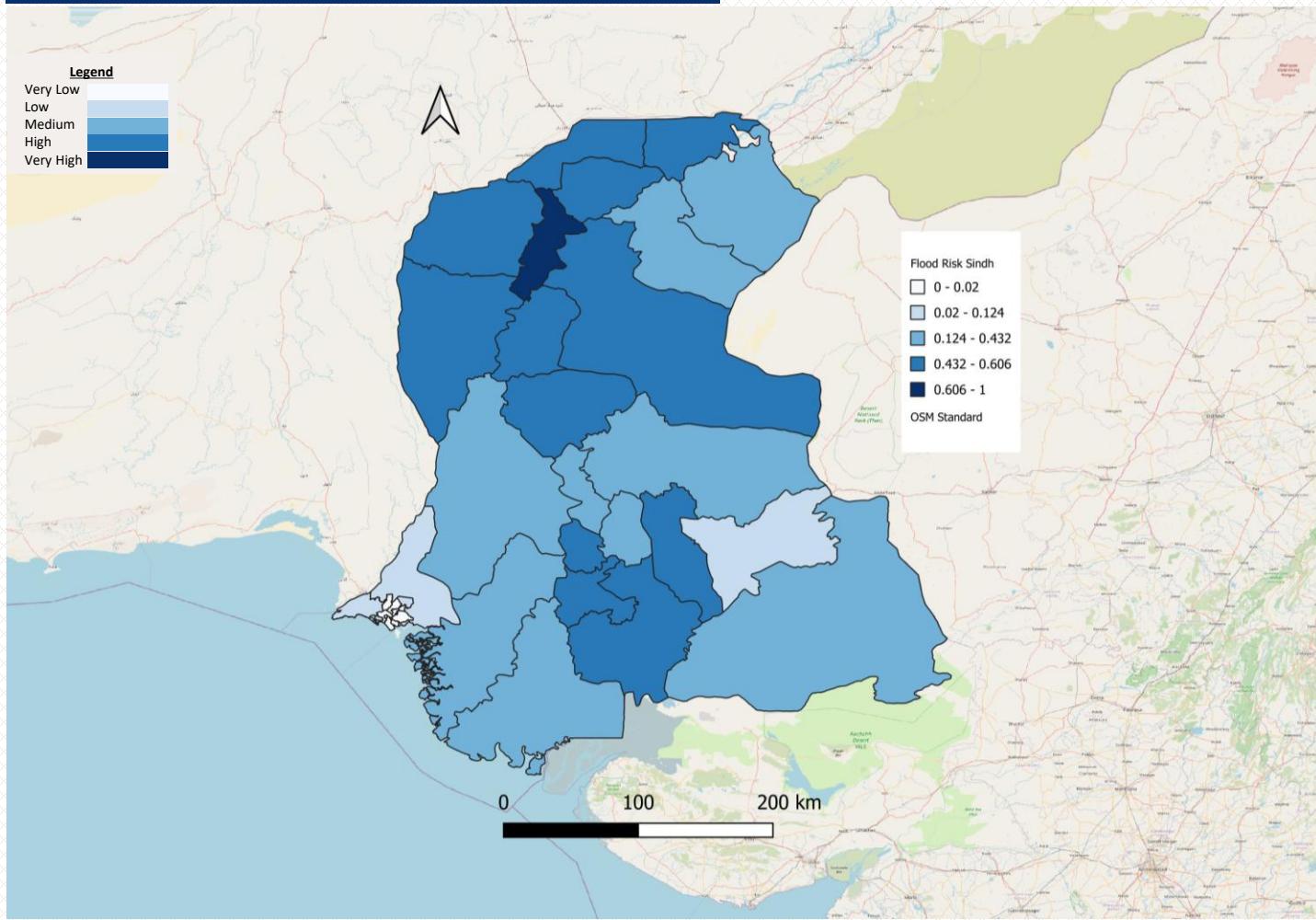
Provincial Maps – Sindh

Flood Hazard

Infrastructure Risk Map

Legend
Very Low
Low
Medium
High
Very High

Flood Risk Sindh
- 0 - 0.02
- 0.02 - 0.124
- 0.124 - 0.432
- 0.432 - 0.606
- 0.606 - 1

OSM Standard

0   100   200 km

Most at Risk Districts

District	Risk
• Larkana	**(Very High)**
• Shikarpur	(High)
• Kashmore	(High)
• Jacobabad	(High)
• Shahadkot	(High)
• Dadu	(High)
• Naushahro Feroze	(High)
• Shaheed Benazirabad	(High)
• Khairpur	(High)
• Mirpur Khas	(High)
• Hyderabad	(High)
• Tando Muhammad Khan	(High)
• Badin	(High)

Provincial Maps
Balochistan

Balochistan, Pakistan's largest and least populated province, is characterized by vast deserts, rugged mountains and expansive coastal plains. The region's diverse landscape includes the dry Rakhshan and Kharan deserts, the striking peaks of the Sulaiman and Makran mountain ranges and a long coastline along the Arabian Sea, which hosts the important Gwadar port. While this geography contributes to the province's resources and economic potential, it also makes its infrastructure highly vulnerable to natural disasters.

Balochistan is situated along the Makran subduction zone, making it prone to earthquakes. The province's infrastructure, especially in major cities like Quetta, faces significant risks from seismic events that can cause widespread damage to roads, buildings and bridges. Additionally, although the region is generally arid, monsoon rains can lead to sudden, severe flash floods, particularly in mountainous and valley areas. These floods often disrupt transportation, destroy infrastructure and endanger communities. This atlas examines the risks that Balochistan's infrastructure faces from earthquakes and floods, aiming to assess the vulnerability of residential buildings and other key structures.

1 - Quetta
2 - Qilla Abdullah
3 - Jafarabad
4 - Sohbatpur
5 - Sherani
6 - Shaheed Sikandarabad
7 - Usta Muhammad
8 - Pashin

Figure 5: *District Map of Balochistan Province*
Source: *Wikipedia*
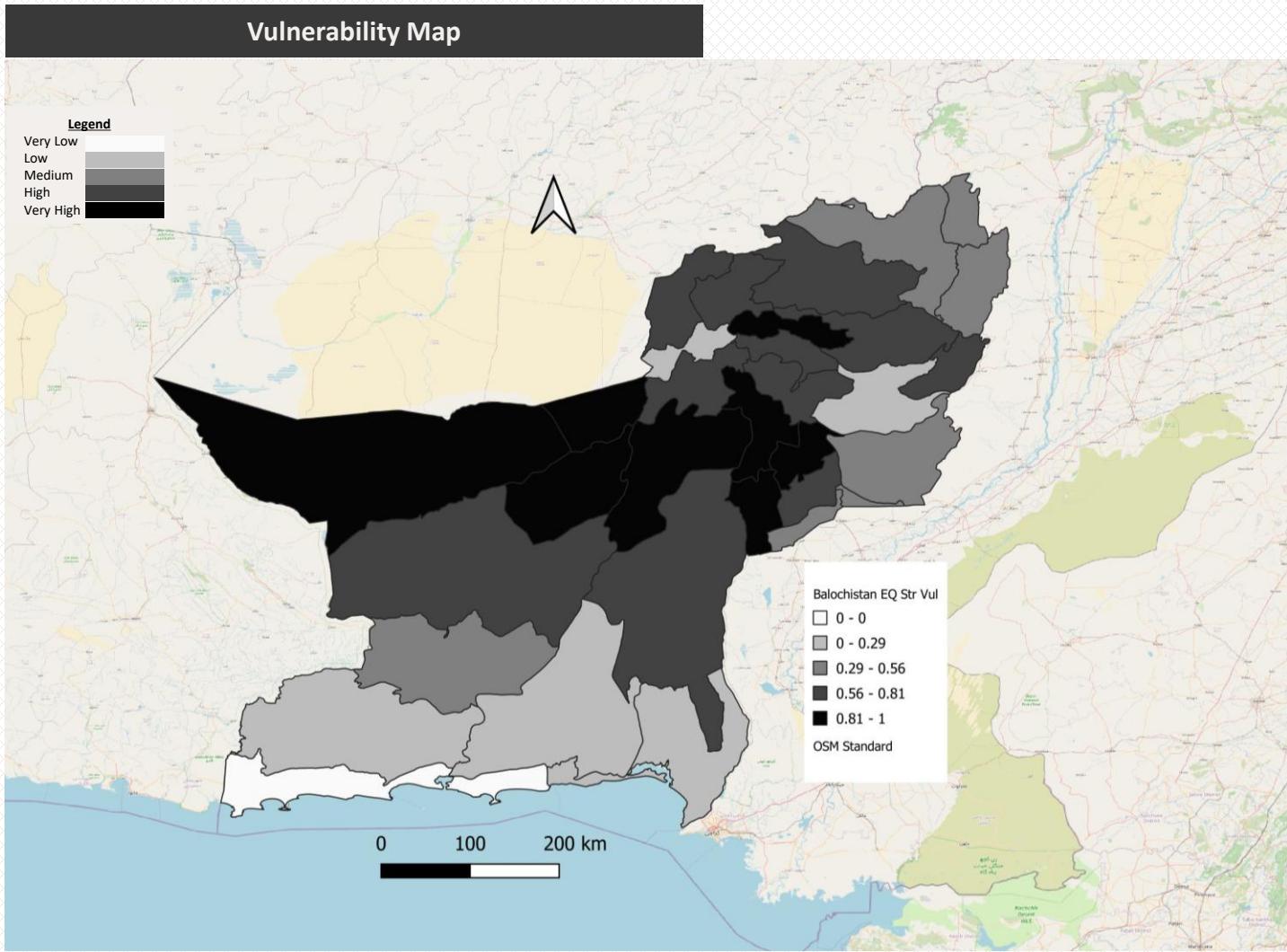
Provincial Maps – Balochistan

Earthquake Hazard

Vulnerability Map

Legend
Very Low
Low
Medium
High
Very High

Balochistan EQ Str Vul
☐ 0 - 0
0 - 0.29
0.29 - 0.56
0.56 - 0.81
0.81 - 1
OSM Standard

0   100   200 km

Most Vulnerable Districts

- **Chaghi**
- **Nushki**
- **Kharan**
- **Qalat**
- **Ziarat**
- **Kachhi**
- **Lehri**
- **Jhal Magsi**
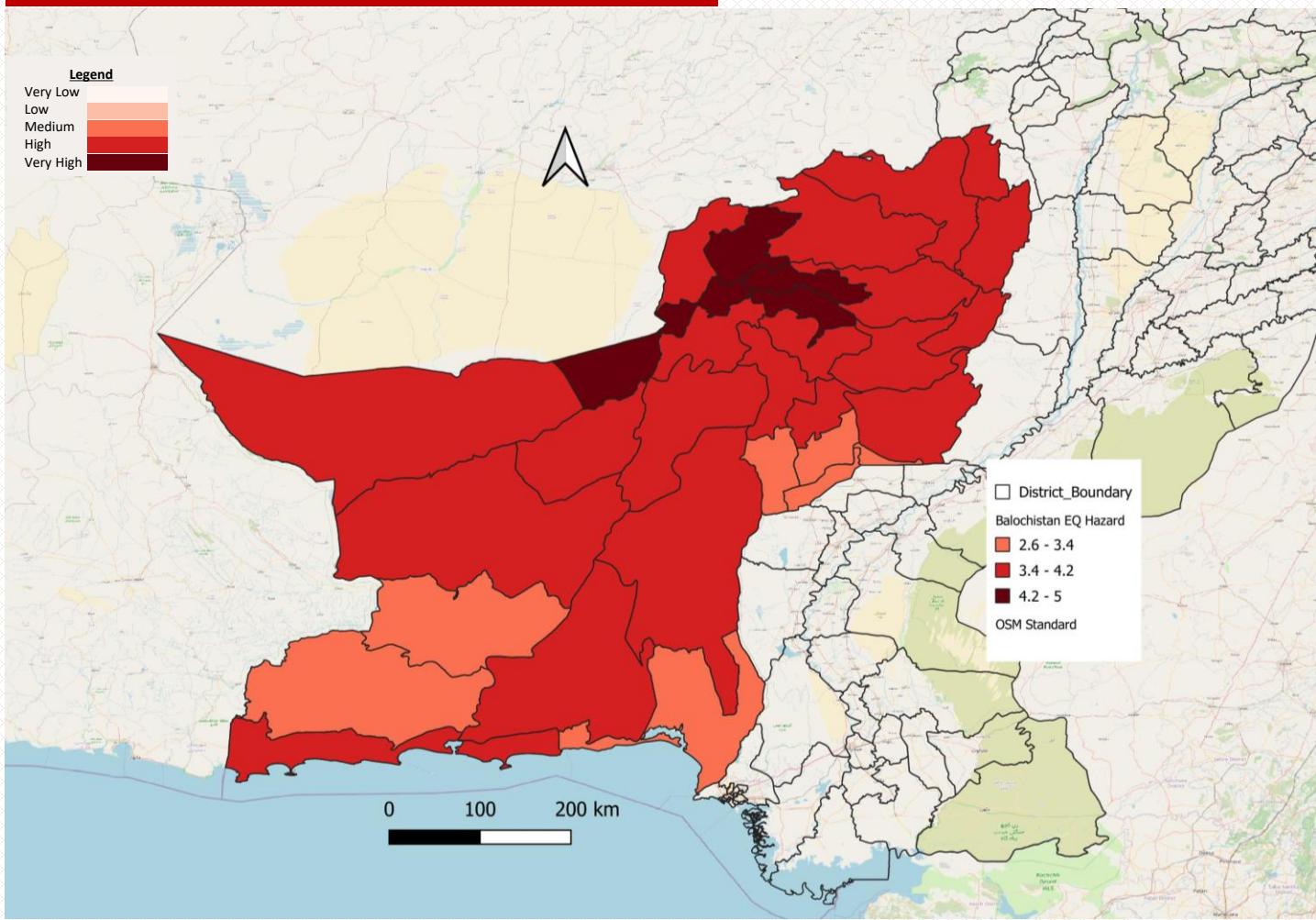
Provincial Maps – Balochistan

Earthquake Hazard

Hazard Map

Most Hazardous Districts

Legend
Very Low
Low
Medium
High
Very High

- **Pishin**
- **Quetta**
- **Nushki**
- **Karezat**
- **Ziarat**
- **Harnai**
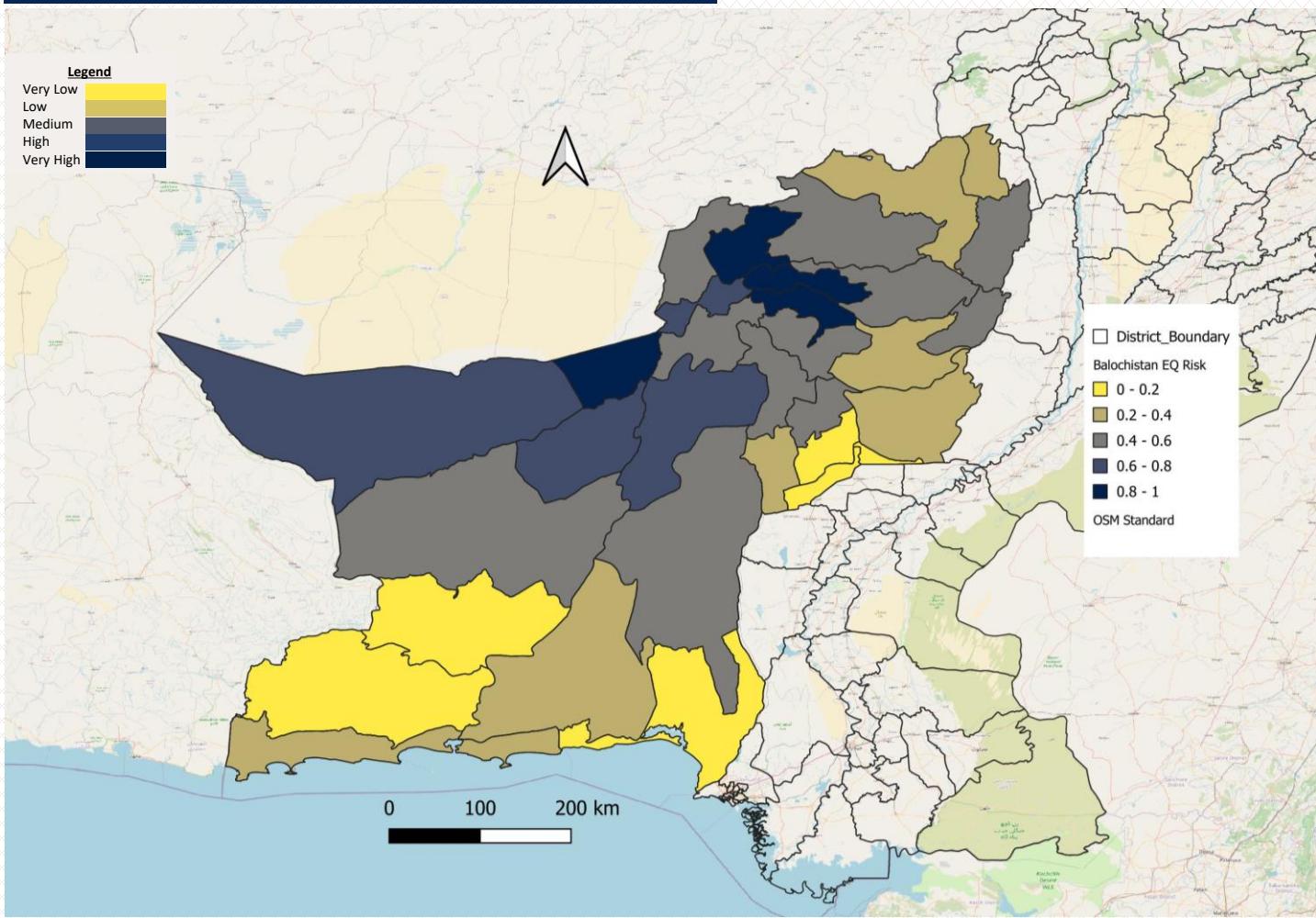
District_Boundary

Balochistan EQ Hazard
2.6 - 3.4
3.4 - 4.2
4.2 - 5

OSM Standard

0   100   200 km

Provincial Maps – Balochistan

Earthquake Hazard

Infrastructure Risk Map

Legend
Very Low
Low
Medium
High
Very High

District_Boundary

Balochistan EQ Risk
0 - 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1

OSM Standard

0   100   200 km

Most at Risk Districts

- **Pishin** **(Very High)**
- **Nushki** **(Very High)**
- **Ziarat** **(Very High)**
- **Harnai** **(Very High)**
- **Karezat** **(Very High)**
- **Quetta** **(High)**
- **Chaghi** **(High)**
- **Kharan** **(High)**
- **Qalat** **(High)**
- **Shaheed Sikandarabad** **(High)**
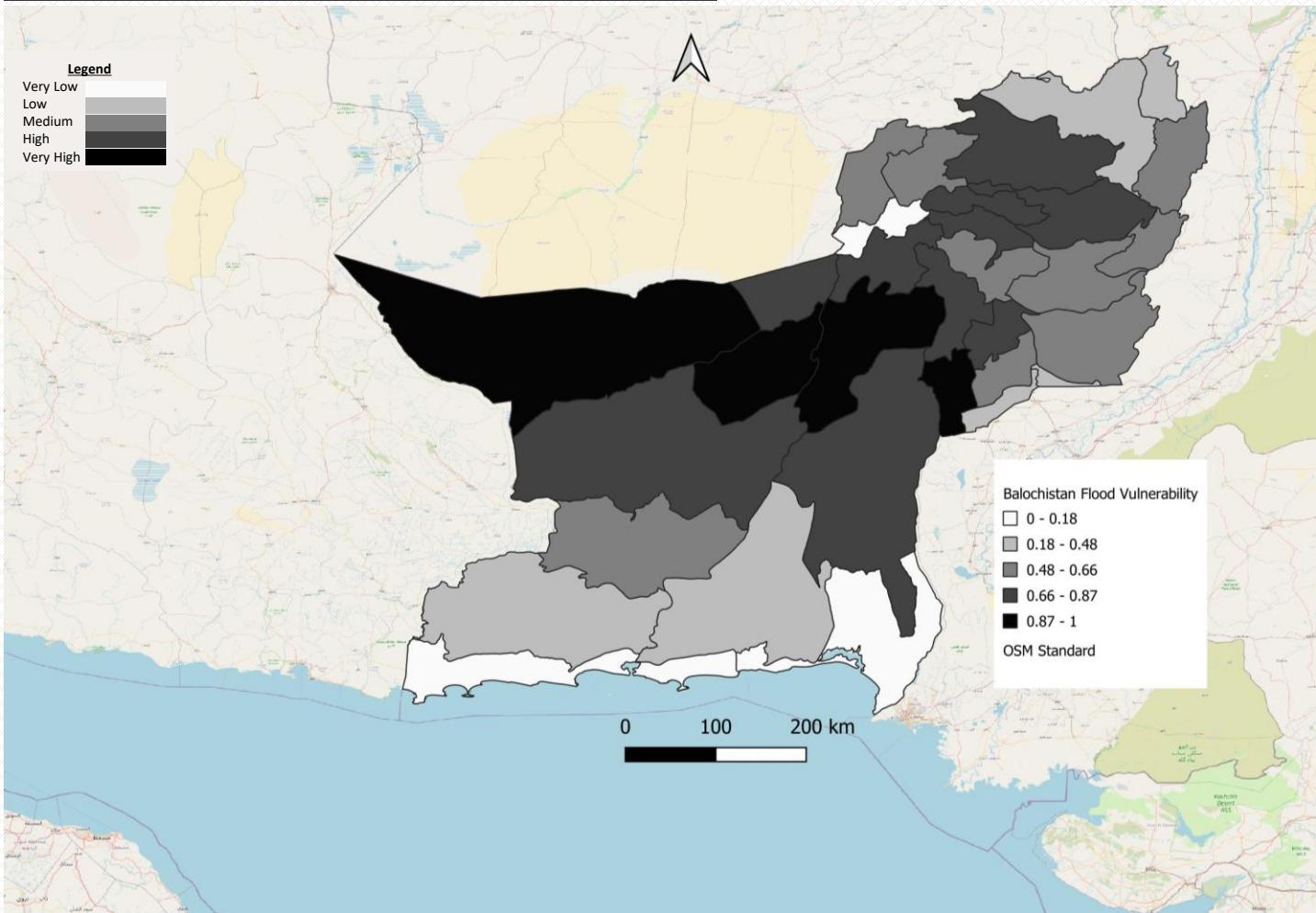
Provincial Maps – Balochistan

Flood Hazard

Vulnerability Map

Most Vulnerable Districts

- **Chaghi**
- **Kharan**
- **Qalat**
- **Shaheed Sikandarabad**
- **Jhal Magsi**
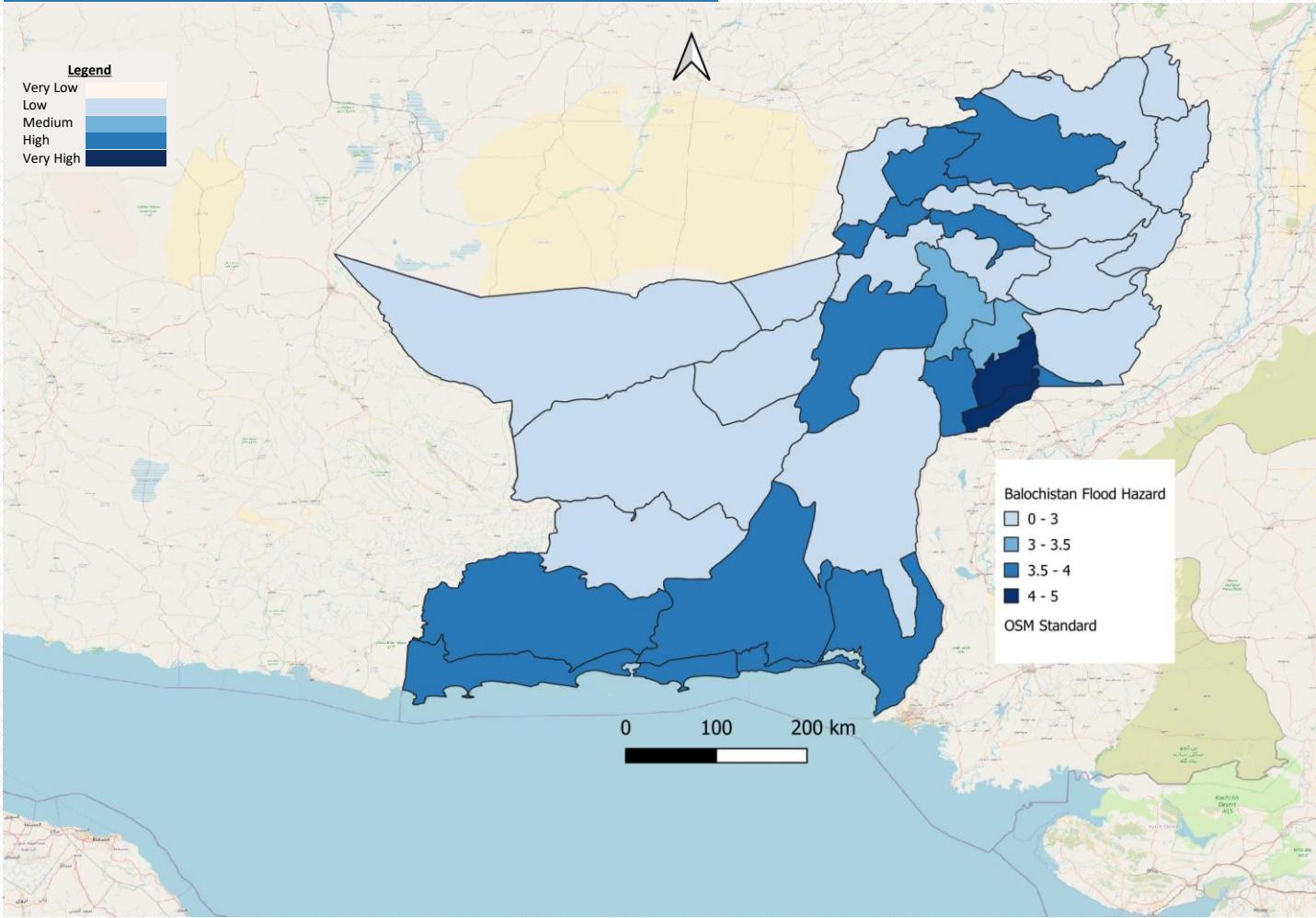
Legend
Very Low
Low
Medium
High
Very High

Balochistan Flood Vulnerability
0 - 0.18
0.18 - 0.48
0.48 - 0.66
0.66 - 0.87
0.87 - 1
OSM Standard

0   100   200 km

Provincial Maps – Balochistan

Flood Hazard

Hazard Map

Legend
Very Low
Low
Medium
High
Very High

Balochistan Flood Hazard
- 0 - 3
- 3 - 3.5
- 3.5 - 4
- 4 - 5

OSM Standard

0   100   200 km

Most Hazardous Districts	
• **Nasirabad**	**(Very High)**
• **Jafarabad**	**(Very High)**
• **Usta Muhammad**	**(Very High)**
• **Jhal Magsi**	**(High)**
• **Qalat**	**(High)**
• **Shaheed Sikandarabad**	**(High)**
• **Quetta**	**(High)**
• **Harnai**	**(High)**
• **Pishin**	**(High)**
• **Karezat**	**(High)**
• **Qilla Saifullah**	**(High)**
• **Kech**	**(High)**
• **Gawadar**	**(High)**
• **Awaran**	**(High)**
• **Lasbela**	**(High)**
• **Hub**	**(High)**
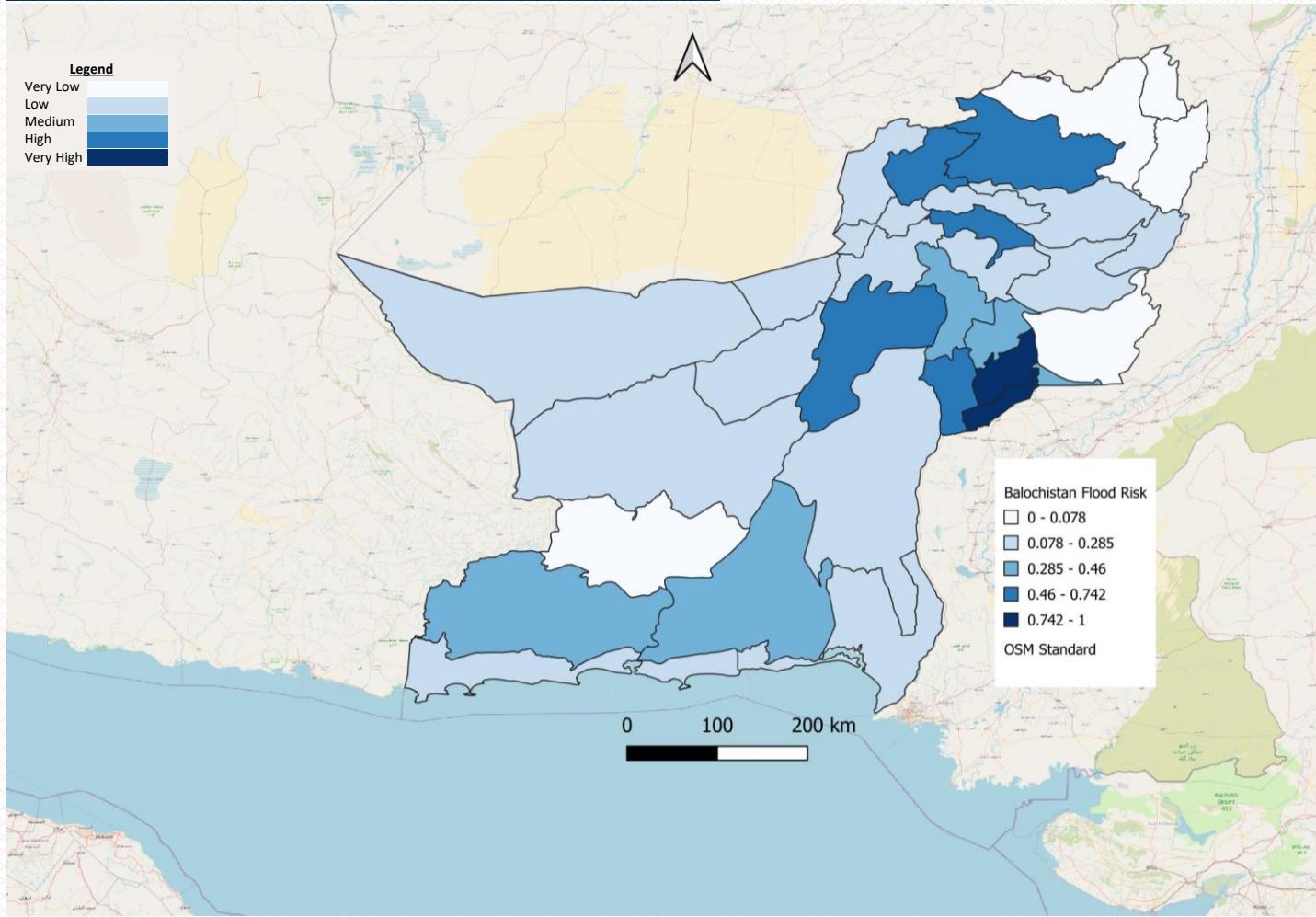
Provincial Maps – Balochistan

Flood Hazard

Infrastructure Risk Map

Legend
- Very Low
- Low
- Medium
- High
- Very High

Balochistan Flood Risk
- 0 - 0.078
- 0.078 - 0.285
- 0.285 - 0.46
- 0.46 - 0.742
- 0.742 - 1

OSM Standard

0   100   200 km

Most at Risk Districts

- **Nasirabad**   **(Very High)**
- **Jafarabad**   **(Very High)**
- **Usta Muhammad**   **(Very High)**
- **Qilla Saifullah**   **(High)**
- **Pishin**   **(High)**
- **Karezat**   **(High)**
- **Harnai**   **(High)**
- **Jhal Magsi**   **(High)**
- **Qalat**   **(High)**
- **Shaheed Sikandarabad**   **(High)**

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Islamabad

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