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# Instrumenting GIS as Smart City Tools to Identify the Impact of Tidal Flood Threat in the Coastal Zone of Pekalongan City

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## Abstract

Pekalongan City, Central Java, Indonesia, is an urban area that often experiences floods and tidal hazards. The topography of Pekalongan City is lower than the sea, resulting in frequent tidal surges. The existence of the Smart City concept encourages the use of digital instruments to identify the extent of built areas that have a threat of tidal floods. Enhanced Built-Up and Bareness Index (EBBI) were used to map built-up areas. At the same time, the GIS method is considered a digital instrumental tool to identify and obtain flood and tidal hazard classes. Results of this study demonstrate three categories of flood and tidal hazards: a low threat of 305,79 hectares or 6.67%, a moderate danger of 1897,94 hectares or 41.94%, and a high threat of 2321,25 hectares or 51,3%. The total area of built areas that fall into the low classification is 22.25 hectares or 1.58%, the medium threat is 784,54 hectares or 55.5%, and the great

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# Instrumenting GIS as Smart City Tools to Identify the Impact of Tidal Flood Threat in the Coastal Zone of Pekalongan City

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**Abstract** Pekalongan City, Central Java, Indonesia, is an urban area that often experiences floods and tidal hazards. The topography of Pekalongan City is lower than the sea, resulting in frequent tidal surges. The existence of the Smart City concept encourages the use of digital instruments to identify the extent of built areas that have a threat of tidal floods. Enhanced Built-Up and Bareness Index (EBBI) were used to map built-up areas. At the same time, the GIS method is considered a digital instrumental tool to identify and obtain flood and tidal hazard classes. Results of this study demonstrate three categories of flood and tidal hazards: a low threat of 305,79 hectares or 6.67%, a moderate danger of 1897,94 hectares or 41.94%, and a high threat of 2321,25 hectares or 51,3%. The total area of built areas that fall into the low classification is 22.25 hectares or 1.58%, the medium threat is 784,54 hectares or 55.5%, and the great danger is 606,62 hectares or 42.8%. From this case, the study also stressed that the circumstances of the Smart City concept had brought more and more exposure to digital instruments employed by local government.

**Keywords** GIS, Smart City, Coastal Zones, Mapping, Hazard

## 1. Introduction

Pekalongan City is a city in the Province of Central Java, located on the north coast of Java Island, with a height of approximately one meter above sea level. Pekalongan City has an area of 45.25 km² divided into 4 sub-districts: West Pekalongan District, North Pekalongan District, East Pekalongan District, and South Pekalongan District. The North Pekalongan District is the widest sub-district, with an area of 1488 ha of Pekalongan City. The smallest subdistrict is the Pekalongan Timur Subdistrict, namely 355,14 hectares.

The topography of Pekalongan City can be said to be low. Pekalongan City is geographically located between 0 and 6 meters above sea level, with slopes ranging from 0 to 8% meters. This condition indicates that the area of Pekalongan City is lowland coupled with soil types, primarily alluvial, and various alluvial types cover Pekalongan City.

Geographically, the location of Pekalongan City is right in the coastal area, which is vulnerable to disasters such as floods and tidal waves. Apart from being caused by the topographical conditions, Pekalongan is surrounded by 3 rivers, the leading cause of flooding: the Loji River, Banger River, and Pekalongan River. The existence of floods and tidal disasters in Pekalongan City has become a common occurrence. The Pekalongan City Government is trying to anticipate disasters, such as training programs for the community and physical prevention by installing flood and tidal barriers on the Loji and Banger rivers.

On the other side, the attraction of a Smart city has provided a new dimension in hazard mitigation. To integrate the Smart City concept, the Pekalongan City Government

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# Elemental Composition of Soils in the Heterogeneous Geological Setting of the Mzymta River Basin on the Russian Black Sea Coast

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**Abstract** This study examines the regional geochemical anomalies in the soil of the Mzymta River valley in Russia, which was affected by large-scale construction works for the 2014 Winter Olympics. The study found that the elemental composition of soils not affected by human activity is influenced by the chemically rich parent rock and the presence of mineralized zones. The abundance and concentrations of excess and deficient elements in the soil were determined using mass spectrometry for 61 elements, and factor analysis was used to identify the causes of the variations observed. The study identified geochemical indicators that can predict soil-forming factors and revealed both natural and anthropogenic sources of chemical elements in the valley soils. Natural sources include geochemically rich rocks that contributed most significantly to the soil chemistry. The anthropogenic sources of elemental variation in the soil were a result of the construction of Olympic transit infrastructure using local geochemically rich materials. The heavy crushing and subsequent intense weathering of this material resulted in an increase in the concentration of excess elements in the soil compared to the parent rock or mineralized zones. This indicates a significant alteration of the soil's elemental composition due to construction activities in the area. The findings of this study can be applied to predict potential soil contamination in similar river valleys that are experiencing both natural and anthropogenic pressures.

**Keywords** Geochemistry, Soil Ecology, Elemental Provenance, Rare Earth Elements

## 1. Introduction

Understanding the quantitative geochemical characteristics of soils and the factors that impact them is crucial for evaluating the extent of chemical contamination in a particular area and determining the soil's residual ecological potential. With increasing urbanization, it becomes more difficult to pinpoint all sources of chemical pollution, but it is necessary to do so in order to develop effective methods for preserving the ecological function of the soil. This is important for maintaining biodiversity, preserving soil fertility, and protecting human health. Conducting a thorough study of the properties of both disturbed and undisturbed soils formed under different natural and human-induced conditions is essential for gaining a comprehensive understanding of the issues and devising effective solutions.

In recent years, there has been significant discussion and research on the geochemical transformations of soils in urban environments. The alkalinization of soils due to the

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# Agricultural Challenges and Adaptation for Changing Climate: A Study on Early Flash Flood-prone Areas in Bangladesh

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**Abstract** Bangladesh's environment and climate have changed a lot and Bangladesh has converted as the most exposed country. This vulnerability is exposed in adverse way in Bangladesh due to magnitude of changing climate. It can be said that for national food security, respective agricultural household should adapt to climate change. A large portion of inhabitants of Bangladesh are dependent on agriculture for their needs, living, income and maintenance, and most importantly economic growth also depends on agriculture. To adapt to climate vulnerability, farmers may face many challenges. In this regard, the first motto was to perceive the level of challenges faced in agriculture such as unpredictable weather, excess cost of inputs, restricted access to agricultural markets, etc. during production. For fulfilling this specific objective, adoption of resilience indices to agriculture were developed. Those adoption resilience indices were making hurdles for farmer's livelihood and adjustment due to climate change. The adoption resilience indices were calculated through the principal confrontation matrix, and it was found that "unpredictable weather" ranked as number one followed by the high cost of farm inputs. Another objective of this exploration was to explore how those adaptation resilience indices affect farmers' enthusiasm for their adaptation. To fulfil this objective, the ordered logit model had been used using 378 boro cultivator's data which were collected from selected 'haor' (lowland) in Sylhet. The results show that the two variables namely "Changed in crop varieties" and "Changed crop to livestock" had a positive impact on the farmers' adapting strategies for changing climate. That means, those farmers were easily motivated to change their crop varieties and preferred rearing livestock during flood.

**Keywords** Perception, Adaptation Planning, Unpredictable Weather, Farmers' Enthusiasm, Flash Flood

## 1. Introduction

Global occurrence due to climate change brings an adverse circumstance to the development of agriculture. It hampers economic activities along with insecurity of food in developing countries [1, 2]. Changing climate also makes hamper to economic value and capital along with drastic changes to ecosystems [1, 3-6].

Agricultural areas are highly affected due to induced water in hostile environment, resulting in severe deteriorations in efficiency, which increases food insecurity. Wang et al. [7] showed rising significant extreme weather events create hardliners for agricultural production. Adaptation is an inevitable effort to adjust with adverse climate in the highly sensitive areas of agricultural dependent economies [8, 9]. To accelerate