

To Find the Best Site for Urban Development in Prachuap Khiri Khan, Thailand

Nasim Jan Taniwall¹, Samiullah Hassan², Muhammad Sharif Haider³, Habibullah Sulaimanzai⁴ and Salih Khan Salih⁵

¹Department of Information Technology, Faculty of Computer Science, Shaikh Zayed University, Khost, AFGHANISTAN

²Department of Information Technology, Faculty of Computer Science, Shaikh Zayed University, Khost, AFGHANISTAN.

³Department of Information Technology, Faculty of Computer Science, Shaikh Zayed University, Khost, AFGHANISTAN.

⁴Department of Information Technology, Faculty of Computer Science, Shaikh Zayed University, Khost, AFGHANISTAN.

⁵Department of Information System, Faculty of Computer Science, Shaikh Zayed University, Khost, AFGHANISTAN.

¹Corresponding Author: nasim.szu@gmail.com



www.ijrah.com || Vol. 3 No. 5 (2023): September Issue

Date of Submission: 20-08-2023

Date of Acceptance: 25-08-2023

Date of Publication: 01-09-2023

ABSTRACT

Coastal areas in the western provinces of Thailand, a popular destination in Northern Thailand, are facing rapid tourism-related sustainable development issues and. This study aims to find the coastal areas which need to be conserved for tourism and find the areas which are safer and suitable for urban development in Prachuap Khirikhan province. Multiple criteria evaluation (MCE) and several available tools in GIS such as 'Reclassify', 'Overlay', 'Proximity', 'Spatial analyst tools' etc. are used during analysis. Based on the available data and multi-criteria analysis, the area in the Prachuap Khirikhan has been classified into five categories from "Highly Suitable" to "Not Suitable. The results show that there are large number of Tambon which are highly suitable for urban development such as Phung Prasan, Kamnoet Noppakhun, Thong chai, Thap sake, Huai Yang, Huai sai, Khlong Wan, Ko Lak, Ao Noi, Bo Nok. The Tambons which are found "Not suitable" or "Low suitable" for urban development are Nong Phap, Nong Ta Taem, Sila Loi and Chang Raek.

Keywords- Best site; Urban development; Sustainable tourism; Multiple Criteria Evaluation; Prachuap khiri Khan.

I. INTRODUCTION

Tourism is one of the major economic activities of the Thailand. Investment in infrastructures and recreational activities and long coastline have led to flourish of tourism in the country [1]. According to World Travel and Tourism Council (WTTC), tourism contributed about 1,037 Billion Baht in 2014 which is about 8.6 % of GDP. Its contribution has been predicted to be about 2,045 Billion Baht by 2025 which will be about 11.9% of total GDP [2].

The study area of Prachuap Khirikhan Province lies in the upper southern Gulf of Thailand. It borders

Phetchaburi to the north, Chumphon to the south and Myanmar to the west.

The province has one of the longest coastlines in the country which is about 250 km. Since 2005, the government had decided to raise and develop Phetchaburi, Prachuap Khiri Khan, Chumphon, and Rayong provinces to be potential clusters which they will be able to develop on the same standard destination as the Rivera/Mediterranean coastline [3].

Table 1-1 below shows that more than 4.5 million tourist visited Prachuap Khirikhan Province in 2014, generating incomes of more than 25 billion Baht.

Table 1-1: Number of tourist and revenues in Prachuap Khirikhan and neighboring Provinces

Province	Thai tourist	International tourists	Total	Incomes (Billion Baht)
Phetchaburi	5,253,509	446,810	5,700,319	19.117
Prachuap Khirikhan	3,730,557	930,437	4,660,994	25.905
Chumphon	1,107,739	96,238	1,203,977	5.281

II. PROBLEM STATEMENTS

Prachuap Khirikhan is known for its beaches and with increasing pressure of tourism, sustainable development of coastal area has become a major issue. Well planned urban development in the coastal region which focuses on tourism should have:

1. Area with tourism activities and recreation
2. Community and residential area
3. Conservation area.

III. OBJECTIVES

The objectives of the study can be broadly divided into

- To find the coastal areas which need to be conserved for tourism in Prachuap Khirikhan province.
- To find the areas which are safer and suitable for urban development in Prachuap Khirikhan province.

IV. LETERATURE REVIEW

4.1. Urban Development in Thailand

Thailand's strategic position and overview of future development trends have been conveyed to the national development policies on the whole by giving priority to urban balance increase and urban clusters development [4]. It is compared with economic activities and progress as well as promoting secondary rural centers to get more strength, be capable of self-reliance, and benefit from regional linkage given that the national development policies have to be compliant and support major issues as follows [5] [6]:

- Populations and workforce distribution
- Economic development
- Urban-rural organization according to proper roles and functions
- Most efficient land-use.
- Development of transportation systems, technology and communication, and energy.

4.2. Coastal Region Development of Thailand

Thailand is a country which has coastal areas in 23 provinces of which 6 provinces are on the Andaman Sea and 17 provinces on the Gulf of Thailand. Prachuap

Khirikhan Province has the longest coast line with 251 kilometers and Bangkok, the capital of Thailand has the shortest coastal line with only 5.5 kilometers [7]. According to the survey of the most popular destinations in Thailand, it found that more than 70 percent favor marine and coastal tourism. The sea, sand and sun are popular with both international and domestic tourists.

Coastal tourism development is highly concentrated within Thailand. It is shown that area such as of Prachuap Khirikhan province is selected for being a tourism marketing cluster, should be primary candidate for study for developing them in a sustainable way because these areas will be further raised and upgraded as an international destination in the future. It has been recommended that the success of the coastal tourism development can be achieved according to how well the supply component matches the demand side. Therefore, it is necessary to study the present tourism situation in the Royal Coast to have the suitable direction and focus on sustainability efforts which involve economic, environmental, social and cultural dimensions [8]. This study attempts to find the suitable areas in Prachuap Khirikhan province for urban development and preservation of area for tourism development using various spatial data and tools.

4.3. Data Acquisition

Following data are used for achieving the above-mentioned objectives.

- Administrative maps (Tambon level).
- Digital Elevation Model (SRTM DEM).
- Road and rail network maps.
- Population data.
- Land use map.
- Tourism Hub and popular beach maps.
- Police Stations and fire stations location maps.

Most of the data are already provided and some additional data are collected from free open source data like Diva-GIS, Earth-explorer.

V. METHODOLOGY

5.1. General methodology

Basic approach used for the research study is shown below in process diagram.



Figure 5-1: Process Diagram

GIS allows for multiple criteria evaluation (MCE). Many studies have shown the application of GIS in urban planning ([9] [10]. This analysis is mainly characterized by allocating weights to assessment criteria for suggesting and ranking alternatives. From the available data, factors considered for preparing suitability map are prepared by reclassifying and assigning weights in logical manner. Several available tools in GIS such as ‘Reclassify’, ‘Overlay’, ‘Proximity’, ‘Spatial analyst tools’ etc. are used during analysis.

To find the best sites for urban development in any area it is necessary to perform detailed analysis of factors that affect the decision-making process. There can be large number of factors that affect the selection of

best sites for urban development and location for costal tourism preservation. Due to time limitation and other factors, we have considered only 3 major factors Physical, Social and Economic, which are further categorized into number of sub-factors.

After data acquisition from various sources, the next step in our project was to perform detailed analysis of those data. Data analysis deals with the discovery of general principles underlying the phenomenon. We analyzed each set of data based on its significance in the study. Meticulous decisions were taken regarding the selection of analysis tool for each data set. Following tools available in Arc-GIS version 10.5.1. has been used for the analysis.

Table 5-1: List of tools used in Arc-GIS

SN	Analysis Metric	Tool used and its description
1	Distance	Euclidean Distance (Calculates, for each cell, the Euclidean distance to the closest source)
2	Surface Analysis	Slope (Identifies the slope (gradient or steepness) from each cell of a raster.
3	Raster Analysis	Raster Calculator (Builds and executes a single Map Algebra expression using Python syntax in a calculator-like interface.)
4	Reclassification	Reclassify (Reclassifies (or changes) the values in a raster.)
5	Mask	Extract by mask (Extracts the cells of a raster that correspond to the areas defined by a mask).
6	Conversion	Polygon to raster (Converts polygon features to a raster dataset.)

Following methods of analysis has been adopted.

Table 5-2: Methods adopted for analysis

SN	Sub factors	Methods
1	Tourist Places	Euclidean Distance – Reclassification
2	Fire Stations	Euclidean Distance – Reclassification
3	Police Station	Euclidean Distance – Reclassification
4	Railway Stations	Euclidean Distance – Reclassification
5	Road Network	Euclidean Distance – Reclassification
6	Population Density	Poly to Raster – Reclassification
7	Land use	Poly to Raster – Reclassification
8	Elevation	Reclassification
9	Slope	Surface Slope – Reclassification

5.2. Multiple Criteria Decision Making

The study included 9 sub factors under 3 major factors, of various importance for decision making. The weightage has been decided based on:

- Requirement: Information about relative importance of these factors.
- Method: The method of Multiple Criteria Decision Making as discussed below has been applied.

The total value for the Multiple Criteria Decision Making has been assigned 100 [11]. The values in the black box indicate the weightage given to each factor. The weights are chosen based on their relative importance. Social, economic and physical factors are assigned weight of 30, 40 and 30 respectively. Further, sub-factors are given weights as present in Figure 3-3.

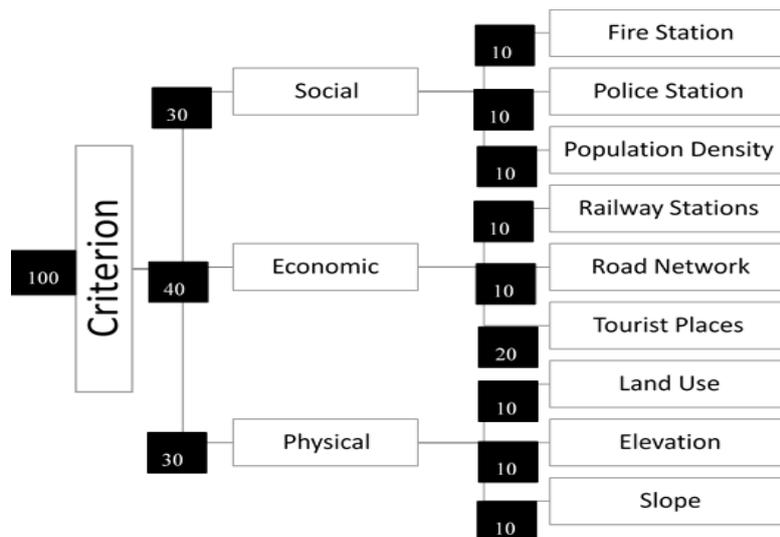


Figure 5-2: Criterial ranking and weighing

Each sub-factor is further classified into several classes and values are assigned based on their relative importance. For example, the assigned value for the slope, categorized as ‘less than 2%’ is 10; slope

‘between 2 to 5%’ is 5; and slope ‘greater than 5%’ is 1. Details for each sub factors have been shown in following tables.

Table 5-3: Values for Social factors

Sub factors	Classes	Value Assigned
Distance from Fire Station (in Km)	<12	10
	12-24	8
	24-36	6
	36-48	4
	>48	2
Police Stations (in Km)	<15	10
	15-30	8
	30-45	6
	45-60	4
	>60	2
Population Density(Person/Km ²)	<30	4
	30-60	8
	60-90	12
	90-120	16
	>120	20

Table 5-4: Values for Economic factors

Criteria	Classes	Value Assigned
Distance from Railway Stations (in Km)	<20	10
	20-40	8
	40-60	6
	60-80	4
	>80	2
Distance from Existing Road	<2	10
	2-5	8

	5-10	6
	10-25	4
	>25	2
Distance from existing Tourist hub (in Km)	<10	20
	10-20	16
	20-30	12
	30-40	8
	40-50	4

Table 5-5: Values for Physical factors

Sub factors	Classes	Value Assigned
Land-use	Suitable	10
	Unsuitable	1
Slope (%)	<2	10
	2-5	5
	>5	1
Elevation (masl)	<3	1
	3-200	10
	>200	5

VI. RESULTS

The final suitability map was generated after following the above-mentioned methodology and analysis. The administrative map available at Tambon

level of the province has been overlaid and it is observed that there are large number of Tambon which are highly suitable for urban development such as Phung Prasan, Kamnoet Noppakhun, Thong chai, Thap sake, Huai Yang, Huai sai, Khlong Wan, Ko Lak, Ao Noi, Bo Nok.

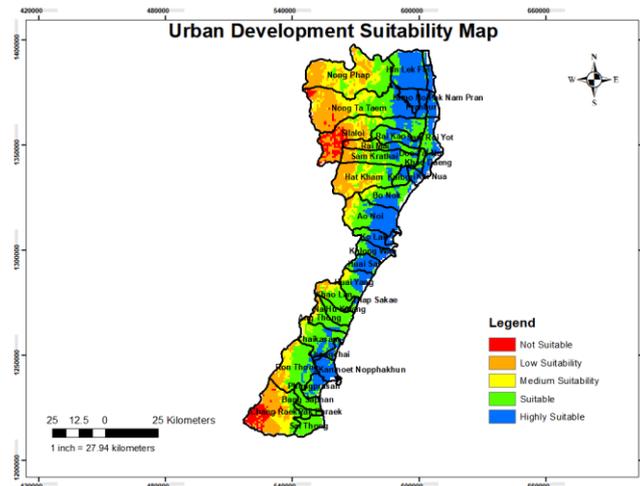


Figure 6-1: Urban Development Suitability Map of Prachuap Khirikhan Province, Thailand

These Tambons are closer to the beach and in close proximity of the available facilities considered in our analysis. The Tambons which are found “Not suitable” or “Low suitable” for urban development are Nong Phap, Nong Ta Taem, Sila Loi and Chang Raek. These Tambons closer far from beaches and to the hills.

Thus, based on the available data and multi-criteria analysis, the area in the Prachuap Khirikhan has been classified into five categories from “Highly

Suitable” to “Not Suitable. Tambons which have large area classified as “highly suitable” and “not suitable” have been identified. However, caution should be taken while interpreting the result as the data used might not cover the whole spectrum of data requirement, weights assigned may not accurately represent their importance. Nevertheless, an exercise has been performed to show the application of GIS in urban development planning focused on tourism.

VII. CONCLUSION

Prachuap Khirikhan is known for its beaches and is the province occupying Thailand's narrowest possession on the Isthmus of Kra, the land bridge connecting the Malay Peninsula with mainland Asia.

The use of multiple criteria analysis for site suitability and ArcGIS in this research has contributed a lot specially in the mapping and representation of the different data gathered. The main objectives of this research were to find the coastal areas which need to be conserved for tourism and to find the areas which are safer and suitable for urban development in Prachuap Khieri Khan, Thailand. Three major factors Such as (social, economic and physical with nine sub-factors were considered to identify suitable area for finding suitable areas for urban development in Prachuap Khiri Khan Province, Thailand. The results show that there are large number of Tambon which are highly suitable for urban development such as Phung Prasan, Kamnoet Nopphakhun, Thong chai, Thap sake, Huai Yang, Huai sai, Khlong Wan, Ko Lak, Ao Noi, Bo Nok.

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