

# Journal of Geography and Regional Planning

Volume 10 Number 1 January 2017

ISSN 2070-1845



## ABOUT JGRP

**Journal of Geography and Regional Planning (JGRP)** is a peer reviewed open access journal. The journal is published monthly and covers all areas of the subject.

**Journal of Geography and Regional Planning (JGRP)** is an open access journal that publishes high-quality solicited and unsolicited articles, in all areas of Journal of Geography and Regional Planning such as Geomorphology, relationship between types of settlement and economic growth, Global Positioning System etc. All articles published in JGRP are peer-reviewed.

### Contact Us

**Editorial Office:** [jgrp@academicjournals.org](mailto:jgrp@academicjournals.org)

**Help Desk:** [helpdesk@academicjournals.org](mailto:helpdesk@academicjournals.org)

**Website:** <http://www.academicjournals.org/journal/JGRP>

**Submit manuscript online** <http://ms.academicjournals.me/>

## Editors

Prof. Prakash Chandra Tiwari,  
*Department of Geography, Kumaon University,  
Naini Tal,  
Uttarakhand,  
India.*

## Associate Editor

Prof. Ferreira, João J  
*University of Beira Interior - Portugal.  
Estrada do Sineiro – polo IV  
Portugal.*

## Editorial Board Members

Dr. Martin Balej, Ph.D  
*Department of Development and IT  
Faculty of Science  
J.E. Purkyne University  
Ústí nad Labem,  
Czech Republic.*

Prof. Nabil Sayed Embabi  
*Department of Geography  
Faculty of Arts  
Ain Shams University  
Cairo,  
Egypt.*

Dr. Eugene J. Aniah  
*Department of Geography and Regional Planning,  
University of Calabar  
Calabar,  
Nigeria.*

Dr. Christoph Aubrecht  
*AIT Austrian Institute of Technology  
Foresight & Policy Development Department  
Vienna,  
Austria.*

Prof. Helai Huang  
*Urban Transport Research Center  
School of Traffic and Transportation Engineering  
Central South University  
Changsha,  
China.*

Dr. Rajesh K. Gautam  
*Department of Anthropology  
Dr. H.S. Gour University  
Sagar (MP)  
India.*

Dulce Buchala Bicca Rodrigues  
*Engineering of Sao Carlos School  
University of Sao Paulo  
Brazil,*

Shaofeng Yuan  
*Department of Land Resources Management,  
Zhejiang Gongshang University  
China.*

## Editorial Board

**Dr. S. K. Florentine**

*Centre for Environmental Management  
School of Science and Engineering  
University of Ballarat  
Victoria  
Australia.*

**Richard Ingwe**

*Centre for Research & Action on  
Developing Locales, Regions and  
Environment (CRADLE)  
Calabar, Nigeria..*

**Dr. Eze B. Eze**

*Department of Geography and Regional Planning  
University of Calabar  
Calabar,  
Nigeria.*

**Cosmina-Simona Toader**

*Faculty of Farm Management  
Banat's University of Agricultural Sciences and  
Veterinary Medicine  
Timisoara,  
Romania.*

**Ladislaus Chang'a**

*Tanzania Meteorological Agency  
Tanzania.*

**Assoc. Prof. Shan-Zhong Qi**

*College of Population, Resources & Environment  
Shandong Normal University  
Jinan,  
China.*

**Dr. Salman Qureshi**

*Department of Geography,  
Humboldt University of Berlin  
Germany.*

**Panagiotis Zervopoulos**

*Department of Economic and Regional Development  
Panteion University of Athens  
Greece.*

**Dr. Ghassem Habibi Bibalani**

*Islamic Azad University  
Shabestar,  
Iran.*

**Dr Emenike Gladys**

*Department of Geography and Regional Planning  
University of Port Harcourt  
Port Harcourt,  
Nigeria.*

**ARTICLE**

<b>Application of geographic information system (GIS) for a suitability assessment of factory placement</b>	<b>1</b>
Uten Thongtip	

*Full Length Research Paper*

# Application of geographic information system (GIS) for a suitability assessment of factory placement

Uten Thongtip

Department of Geographical Technology, Faculty of Humanities and Social Sciences, Phranakhon Rajabhat University, Bangkok, Thailand.

Received 30 November, 2016; Accepted 27 December, 2016

In this study, a geographic information system was used to determine land suitability for locating type 1, type 2 and type 3 factories in Lam Thap District, Krabi Province, Thailand. Environmental factors used to assess suitability were proximity to roads, rivers, urban areas, public areas, watershed areas, forest areas, wildlife areas, as well as land use type. Numerical weights of the main factors were assigned and suitability rankings were derived from a survey of experts as well as legal information relating to factory placement. A series of overlays were conducted and ranks from each layer were combined additively to form a final suitability score for all type of factories. The results from this study suggest that the total area of marginally, moderately and highly suitable land for type 1 factories was 4.42% of the total study area, 0.10 and 0.75%, respectively. The remaining area of 94.73% was considered unsuitable for factory type 1 placement. The total area of marginally, moderately and highly suitable land for type 2 factories was 2.36, 0.72 and 0.11%, respectively. The remaining area of 96.81% was considered unsuitable for factory type 2 placement. The total area of marginally, moderately and highly suitable land for type 3 factories was 2.94%, 2.45% and 0.87%, respectively. The remaining area of 93.74% was considered unsuitable for factory type 3 placement. A comparison of the area of suitable land for all factory type, reveals that highly suitable land for type 3 factories covers more area than other type of factories. High suitability (0.87%) for factory type 3 was due to the fact that much of the land is abandoned area or still far away from urban areas, public areas, forest areas, wildlife areas, roads and rivers.

**Key words:** Geographic information system, suitability assessment.

## INTRODUCTION

The National Research Council of Thailand (2011) formulated the eighth National Research Policy and Strategy (2012 to 2016), which commanded high quality research towards a new body of knowledge to develop

the country. This supports the potential to improve research works and new innovations as well as enhancements to new knowledge in social science and geo-information for a balanced and sustainable national

E-mail: [tane\\_geog@hotmail.com](mailto:tane_geog@hotmail.com).

Author agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)



development.

Krabi Province has been giving the importance to the development of the green world under the concept of Krabi Goes Green. It is employing strategies to stabilize agricultural production, e.g., supporting Lam Thap District to be rubber and palm plantations and a centre for other agricultural products. The province also supports the ongoing development of factory that facilitates agricultural productions, which are pollution-free and friendly to environment and the community (Krabi Provincial Hall, 2013).

An evaluation conducted by the Department of Industrial Works indicated that the level of pollution caused by factories located in Lam Thap District is not at a critical level at the moment. However, data indicates that more than 50% of the factories produce some pollution and are likely to worsen the problem to a serious level. To control and protect against the pollution problems in the near future, it is important that the environmental factors should be considered for factory zoning and planning (Krabi Industrial Office, 2016).

The people in the area have suffered so heavily from the plant latex and palm oil mill that they complained. About 100 of them signed a petition and handed it to the district office, the province's industry office, the governor of Krabi Province to request them to solve the problem (Dailynews, 2015). The researcher conducted a field trip to study the issue and met with the public. It was found that Lam Thap has been facing environmental problems caused by factories. The local people wanted to have a study that explores and searches for a more suitable location for the industry base. Results can be used to prevent the expansion of the factories and protect agricultural areas from the encroachment of urban and industrial activities in the future. The Geographic Information System (GIS) is a technology that can analyse the suitability of the industry. Therefore, the GIS will be applied in this study in conjunction with the analysis of the factory laws. This is in order to manage industry effectively and in accordance with the measures to protect the environment and to maximize the benefits of all kinds.

This research article is purposed to present suitability assessment of factory placement in Lam Thap District, Krabi Province, Thailand using the GIS which is a spatial data management system. It is useful for the Land Suitability Evaluation, which is a tool used extensively by the SIEVE Analysis technique which converts the factor data into a geographic map and then all of the maps are overlaid according to Boolean algebra. The areas with higher scores will be overlaid on a geographic map. The result of the analysis is shown on a geographic map.

## METHODOLOGY

In this study, a geographic information system was used to

determine land suitability for locating type 1, type 2 and type 3 factories in Lam Thap District, Krabi Province, Thailand (Type 1 factories do not produce any pollution, type 2 produces relatively little pollution and type 3 produces the most). Environmental factors used to assess suitability were proximity to roads, rivers, urban areas, public areas, watershed areas, forest areas, wildlife areas, as well as land use type. Numerical weights of the main factors were assigned and suitability rankings were derived from a survey of experts as well as legal information relating to factory placement (Tables 1 to 3). After that, the maps are overlaid, which is called (Overlay Analysis) based on Boolean algebra (NC Division of Coastal Management, 2005; Baniya, 2008; Mohammad and Mohammad, 2014). GIS is used in this technique for analysis and the concept is as shown in Figure 1.

The first step was identification of relevant datasets for the study. In this, the factors are roads, rivers, urban areas, public areas, watershed areas, forest areas, wildlife areas and land use. These datasets were collected from remote sensing data processing. Following this, data editing and creation of a database for efficient data management was done. The various factors affecting land suitability were then processed, standardized, weighted and overlaid to produce individual suitability maps and a final suitability map (Department of Natural Resources and Mines, 2013).

Next, the suitability score of all factors is determined. "S" is the Total Suitability Score, "n" is the number of factors and "R" is the weight of the suitability score of each factor from 1 to n as Equation 1 (Victorian Government, 2006).

$$S = \sum_{i=1}^n R_i \quad (1)$$

The area then is divided, this research article divided the area into 4 levels (or 4 intervals): highly suitable, moderately suitable, marginally suitable and unsuitable area (Tables 4 to 6).

## RESULTS AND DISCUSSION

The results from this study suggest that the total area of marginally, moderately and highly suitable land for type 1 factories was 12.44 km<sup>2</sup> or 4.42% of the total study area, 0.27 km<sup>2</sup> or 0.10% and 2.12 km<sup>2</sup> or 0.75%, respectively. The remaining area of 266.78 km<sup>2</sup> or 94.73% was considered unsuitable for factory type 1 placement (Figure 2). The total area of marginally, moderately and highly suitable land for type 2 factories was 6.66 km<sup>2</sup> or 2.36%, 2.02 km<sup>2</sup> or 0.72% and 0.30 km<sup>2</sup> or 0.11%, respectively. The remaining area of 272.63 km<sup>2</sup> or 96.81% was considered unsuitable for factory type 2 placement (Figure 3). The total area of marginally, moderately and highly suitable land for type 3 factories was 8.29 km<sup>2</sup> or 2.94%, 6.89 km<sup>2</sup> or 2.45% and 2.45 km<sup>2</sup> or 0.87%, respectively. The remaining area of 263.98 km<sup>2</sup> or 93.74% was considered unsuitable for factory type 3 placement (Figure 4). A comparison of the area of suitable land for all factory type, reveals that highly suitable land for type 3 factories covers more area than other type of factories. High suitability (0.87%) for factory type 3 was due to the fact that much of the land is abandoned area or still far away from urban areas, public areas, forest areas, wildlife areas, roads and rivers.

**Table 1.** The factor of land suitability for locating type 1.

Factor	Value	Score	Weight
Road	0 - 50	0	2
	50 - 100	3	
	100 - 200	2	
	> 200	2	
River	0 - 50	0	3
	50 - 100	2	
	> 100	2	
Urban area	Urban area	0	3
	0 - 50	2	
	> 50	2	
Public area	0 - 50	0	4
	> 50	2	
Land use	Village	0	3
	Paddy filed	1	
	Orchard	1	
	Farm house	2	
	Open space	3	
	Wilderness area	3	
	Orchard/Village	2	
	Other	2	
Conservation area	Watershed 1 and 2		Restricted
	Forest		
	Wildlife		

**Table 2.** The factor of land suitability for locating type 2.

Factor	Value	Score	Weight
Road	0 - 50	0	2
	50 - 100	2	
	100 - 200	2	
	> 200	2	
River	0 - 50	0	3
	50 - 100	2	
	> 100	2	
Urban area	Urban area	0	3
	0 - 50	1	
	> 50	2	
Public area	0 - 50	0	4
	> 50	2	
Land use	Village	0	3
	Paddy filed	1	
	Orchard	1	
	Farm house	2	



**Table 2.** Cont'd

	Open space	2	
	Wilderness area	3	
	Orchard/Village	1	
	Other	2	
Conservation area	Watershed 1 and 2		
	Forest		Restricted
	Wildlife		

**Table 3.** The factor of land suitability for locating type 3.

Factor	Value	Score	Weight
	0 - 50	0	
Road	50 - 100	2	3
	100 - 200	2	
	> 200	3	
	0 - 50	0	
River	50 - 100	1	4
	> 100	2	
	Urban area	0	
Urban area	0 - 50	1	5
	> 50	3	
	0 - 50	0	
Public area	> 50	3	5
	Village	0	
	Paddy field	1	
	Orchard	1	
Land use	Farm house	2	4
	Open space	2	
	Wilderness area	3	
	Orchard/Village	1	
	Other	2	
Conservation area	Watershed 1 and 2		
	Forest		Restricted
	Wildlife		

## Conclusion

This research article presents the land suitability for locating type 1, type 2 and type 3 factories in Lam Thap District, Krabi Province, Thailand. There are 8 main factors used for the analysis, including the road factor, the river factor, the urban area factor, the public area

factor, watershed area factor, forest area factor, wildlife area factor, and the land use factor.

A comparison of the area of suitable land for all factory type, reveals that highly suitable land for type 3 factories covers more area than other type of factories. High suitability (0.87%) for factory type 3 was due to the fact that much of the land is abandoned area or still far away

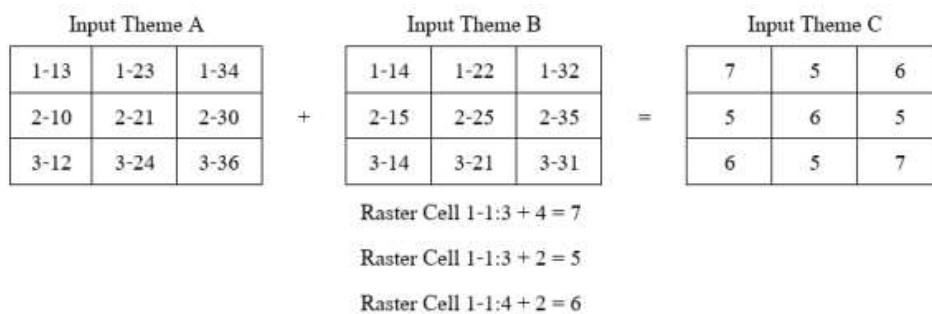


Figure 1. Overlay SIEVE Analysis using addition (NC Division of Coastal Management, 2005).

Table 4. Suitability level classes (type 1).

Suitability	Score
Highly suitable	33 - 35
Moderately suitable	30 - 32
Marginally suitable	27 - 29
Unsuitable	6 - 26

Table 5. Suitability level classes (Type 2).

Suitability	Score
Highly Suitable	30 - 33
Moderately Suitable	27 - 29
Marginally Suitable	24 - 26
Unsuitable	3 - 23

Table 6. Suitability level classes (type 3).

Suitability	Score
Highly Suitable	50 - 59
Moderately Suitable	43 - 49
Marginally Suitable	34 - 42
Unsuitable	3 - 33

from urban areas, public areas, forest areas, wildlife areas, roads and rivers.

Lam Thap District, Krabi Province has been giving the importance to the development of the green world under the concept of Krabi Goes Green. It is employing strategies to stabilize agricultural production, e.g., supporting Lam Thap District to be rubber and palm plantations and a centre for other agricultural products. The province also supports the on-going development of

industry that facilitates agricultural productions, which are pollution-free and friendly to environment and the community. The GIS is a technology that can analyse the suitability of the factory. Therefore, the GIS will be applied in this study in conjunction with the analysis of the factory laws. This is in order to manage industry effectively and in accordance with the measures to protect the environment and to maximize the benefits of all kinds.

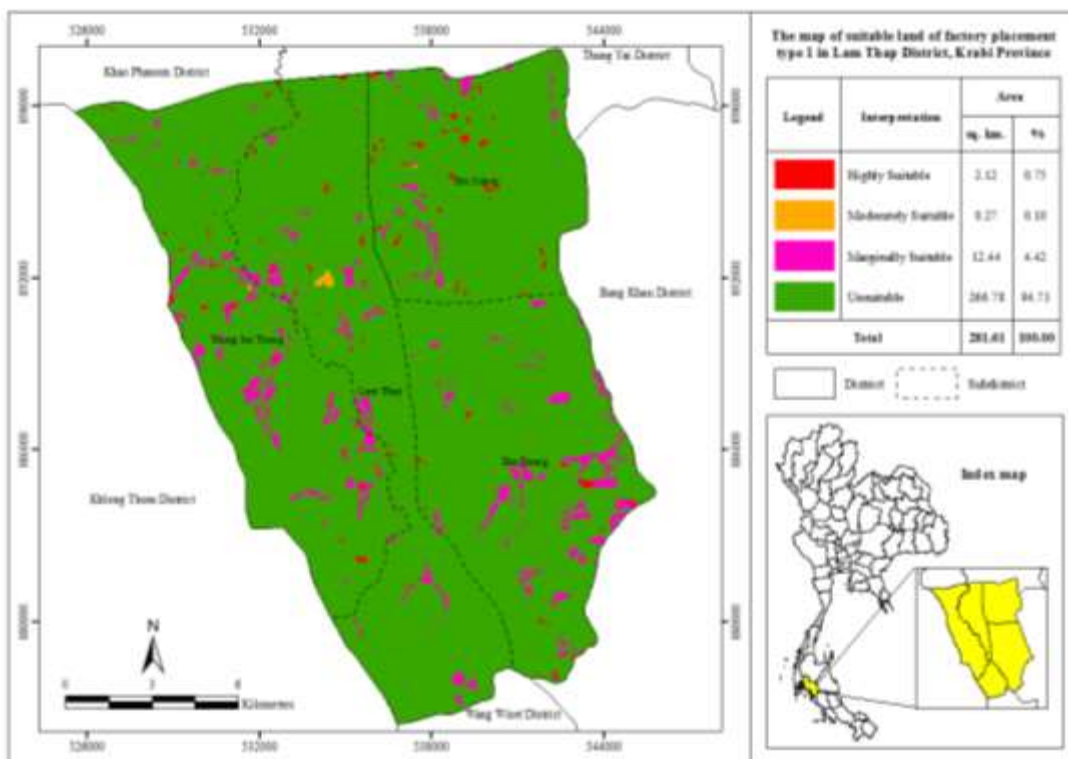


Figure 2. The map of suitable land of factory placement type 1.

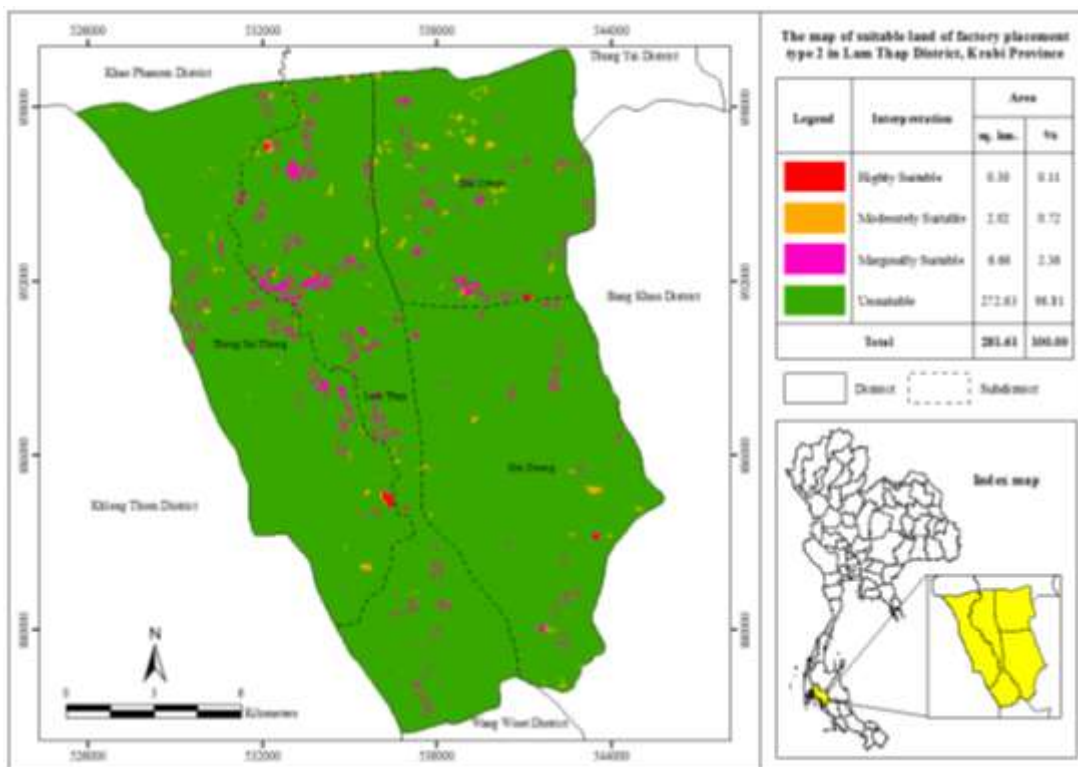


Figure 3. The map of suitable land of factory placement type 2.

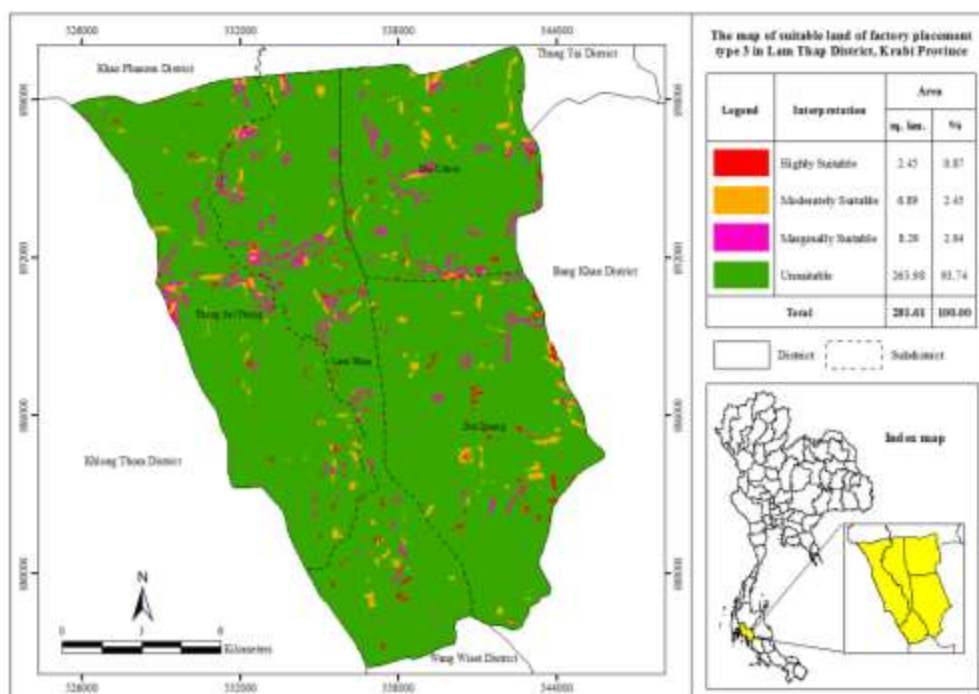


Figure 4. The map of suitable land of factory placement type 3.

## Conflict of Interests

The author has not declared any conflicts of interest.

## REFERENCES

- Baniya N (2008). Land suitability evaluation using GIS for vegetable crops in Kathmandu Valley, Nepal. Berlin: Faculty of Agriculture and Horticulture, Humboldt-Universität zu Berlin.
- Dailynews (2015, February 1). Lam Thap: The problem of sewage. Retrieved from <http://www.dailynews.co.th>.
- Department of Natural Resources and Mines (2013). Guidelines for land suitability and financial viability requirements for high-value and irrigated high-value agriculture. Queensland, Australia: Land and Mines Policy, Department of Natural Resources and Mines.
- Krabi Industrial Office (2016). Krabi economic and social development plan. Krabi, Thailand: Krabi Industrial Office.
- Krabi Provincial Hall (2013). Krabi development plan 2014-2017. Krabi, Thailand: Krabi Provincial Hall.
- Mohammad SNK, Mohammad MAK (2014). Land suitability analysis for sustainable agricultural land use planning in Bulandshahr District of Uttar Pradesh. Int. J. Scientific Res. Publications 4(3):11-11.
- National Research Council of Thailand (2011). National research policy and strategy (2012-2016). Bangkok, Thailand: National Research Council of Thailand.
- NC Division of Coastal Management (2005). Land suitability analysis user guide for ArcView 3.x and ArcGIS 9.x. North Carolina: NC Center for Geographic Information and Analysis.
- Victorian Government (2006). Grow West – Land suitability analysis of the shire of Moorabool. Victoria, Australia: Victorian Government Department of Primary Industries.



# Journal of Geography and Regional Planning

## Related Journals Published by Academic Journals

- Journal of Economics and International Finance
- Journal of Hospitality Management and Tourism
- International Journal of Sociology and Anthropology
- Journal of Public Administration and Policy Research
- African Journal of Marketing Management

**academicJournals**