

# Journal of Environment and Earth Science



**IISTE**

International Institute for Science, Technology & Education  
Accelerating Global Knowledge Creation and Sharing



## Journal of Environment and Earth Science

[Home](#) > [Archives](#) > [Vol 6, No 4 \(2016\)](#)

### Vol 6, No 4 (2016)

[Home](#)
[Search](#)
[Current Issue](#)
[Back Issues](#)
[Announcements](#)
[Full List of Journals](#)
[Migrate a Journal](#)
[Special Issue Service](#)
[Conference Publishing](#)
[Editorial Board](#)
[OPEN ACCESS Policy](#)
[FONT SIZE](#)
[JOURNAL CONTENT](#)








[CURRENT ISSUE](#)


### Table of Contents

#### Articles

A Case Study of Six Land Conflicts in Bayelha State, Nigeria <i>Enive Mienye</i>	PDF 1-10
A Study of Sanitation Problems in Kumasi Metropolitan, Ghana <i>Andrews Fwadwo Sarfo Danso</i>	PDF 11-14
Can Conservation Agriculture Techniques Mitigate Inter-Seasonal Drought Effects on Crop Yield in Steep Land? Case of the Southern Illuic Mountains, Tanzania <i>Ndabhemnye Mlengera, A, Peter W. Mtakwa, Baanda A. Salim, Geoffre C. Mrema</i>	PDF 15-23
Environmental Health Behavior and Mobility of Children in Community Settlements in Peverbanks Itang <i>Budjanto, Singih Susilo</i>	PDF 24-29
Facies Analysis and Depositional Environment of the Eocene and Miocene in the Eocene in Najaf and Samawa Areas, Southern Iraq <i>Mazin Y. Tamar-Agha, Safaa Adeeab Saleh</i>	PDF 30-39
The Strategic Model of Human-Centered Coastal Ecosystem Development in Mandeh Regions, West Sumatera, Indonesia <i>Dedi Hermon</i>	PDF 40-45
The Significance of Honey Production for Livelihoods in Nigeria <i>Fenet Belay Daba, Alemayehu Oljirra</i>	PDF 46-53
Conceptual Aspect of Hydrological Cycle in Indian City: Study of Kolkata, India, Ramayana <i>Sadhan Malik</i>	PDF 54-59
Perception of Seasonal Climate Forecast Information on Smallholder Farmers in Rural and Semi-rural Kenya: A Case Study <i>Morris M. Mwatu, Charles W. Recha, Janepha K. Kumbha</i>	PDF 60-63
The Saginaw City of the Past: Its Resistant Residents' Property Use Pattern <i>Aliyu Ahmad Aliyu, Rozilah Kasim, David Martin, Abdu Ibrahim Garkuwa, Maryam Salihu Muhammad</i>	PDF 64-82
A New Species of Dryobalanus from Deer Berger Forest, Mayyeh Ligite Formation, Tamil Nadu, India <i>KUMARASAMY, D. ELAYARAJA, M</i>	PDF 83-87
Long-Term Trend of the All-India Annual Summer Monsoon Rainfall and its Association with the ENSO Index <i>Rafique Ahmed, M. Shamsul Alam, M. Matinur Rahman</i>	PDF 88-94
Changing Patterns of Ground Water Level in Patel Nagar District of Haryana, India <i>Sandeep Kumar, Pooja Rani, Hardeep Rai Sharma</i>	PDF 95-98
Analysis of Rainfall Variability and Farmers' Perception towards it in Agrarian Community of Southern Ethiopia <i>Negash Wagesho Eshetu Yohannes</i>	PDF 99-107
Extract of Toxic Kunc Plant ( <i>Dioscorea Pandurata</i> ) as Bioinsecticide Larvae of Culex and Aedes Mosquito <i>Marik, Nur Haidah, AT Diana Nerawati</i>	PDF 108-110
Environmental Impact of Trawling on the Continental Shelf of Bay of Bengal <i>Mahua Das</i>	PDF 111-127
The Effect of Land Speculation on Urban Planning and Development in Eastern Area, Cirebon City Government <i>Phanuel B. Joshua, George Godwin Glanda, Felix A. Ilesanmi</i>	PDF 128-133
Intuitive Geophysics Concentration in a Freshwater Lake Using Aerial Imager <i>Zhiming Yang, Yolanda Anderson</i>	PDF 134-142
Techniques in Disaster Management and Disaster Risk Reduction: A Review of Applications <i>V. Rathore</i>	PDF 143-145
Derivation of Fluoride in Aqueous Activated Carbon Prepared From Selected Agricultural Waste Materials <i>John Benti, William Kwame Buah</i>	PDF 146-152



### About Journal of Environment and Earth Science

Journal of Environment and Earth Science is a peer reviewed journal published by IISTE. The journal publishes original papers at the forefront of Environment and Earth Sciences. The journal is published in both printed and online versions.

Journal of Environment and Earth Science is published by IISTE and follows a monthly publication schedule

General inquiries and Paper submission: [contact@iiste.org](mailto:contact@iiste.org) or [JEES@iiste.org](mailto:JEES@iiste.org)

### Index of this journal



### IISTE's acknowledgements to the supports from co-hosting universities worldwide

- University of North Carolina at Charlotte, United States
- California State University, United States
- The City University of New York, United States
- Aristotle University of Thessaloniki, Greece
- Universiteit Leiden, Netherlands

### **About IISTE**

The International Institute for Science, Technology and Education (IISTE) is an independent organization delivering supports and services to education professionals and researchers around world.

### **History & Missions**

The International Institute for Science, Technology and Education (IISTE) was established in 2008. In partnership with government, community organizations, public agencies, enterprises and other foundations, IISTE offers a variety of programs and activities to promote education development, international collaboration, including scientific publication, financial support for researchers and international academic projects (conference, workshops, etc). IISTE holds a number of academic journals, covering social science, engineering, economics and management. All the submissions to these journals will be subjected to peer-reviews, and the published ones are open-access (OA) for everyone to download. IISTE is also actively looking for academic activity proposals, such as conference, symposium, tutorial sessions and demo-shows. Possible supports from IISTE include one-time grants (up to \$7500), publication support and local networking opportunities with the members and authors of the IISTE.

### **Contact Us**

IISTE US Office

contact@iiste.org

Suite 1314, 258 Madison Avenue, New York, NY 10016 United States

IISTE UK

UK@iiste.org

Office Suite 310, 12 Melcombe Place London, NW1 5JJ United Kingdom

### **Printing and redistribution of paper materials**

The printing of IISTE journals is managed by the ColorWorks Service (Beijing) Limited. ColorWorks Service (Beijing) Limited is a subcontractor of IISTE and IISTE reserves all rights related to the copyright materials as well as other information related to the journals.

## Acknowledgement of Editors and International Reviewers

Prof. Dr Ibrahim Hassan  
Alexandria University, Egypt

Prof. Dr. H. K. Sharma  
Maharishi Markendeshwar University, India

Prof. Dr. P. Satheshkumar  
Central Marine Fisheries Research Institute, India

Prof. Dr. M.Anjan Kumar  
Jawaharlal Nehru Technological University, India

Prof. Dr. L. Wang  
Zhejiang University, China

Dr. Ass.Prof. Ahmed Hashim Mohaisen Al-Yasari,  
University of Babylon, Iraq.

Prof. Dr. Y.F. Liu  
Nanjing University, China

Dr. Chiung Ting Chang  
Maastricht University, Netherlands

Prof. Dr. Carlos K B Ferrari  
Federal University of Mato Grosso (UFMT), Brazil

Dr. Suleyman A. Muyibi  
International Islamic University Malaysia

Prof. Dr. Venus S. Solar  
Manila Central University, Philippines

Dr. Eng. Rares Halbac-Cotoara-Zamfir  
"Politehnica" University of Timisoara Romania

Prof. Dr. Ugur GUVEN  
University of Petroleum and Energy Studies, India

Dr. ADEKUNLE, V.A. J.  
Federal University of Technology, Nigeria

Dr. Nabil Miled  
Sfax University, Tunisia

Dr. ERINA RAHMADYANTI, S.T.,M.T  
State University of Surabaya, Indonesia

Dr. Mostafa Nejati Ajibishah  
Universiti Sains Malaysia (USM), Malaysia

## International Journals Call for Papers

IISTE hosts and publishes more than 30 international academic journals in various fields **MONTHLY**. Prospective Authors can send their full manuscript(s) to the journals for review and possible publication.

- You must read the paper submission guide and use the IISTE standard paper template. Draft your paper based on the Paper Template provided on [www.iiste.org](http://www.iiste.org) will help you to go through the review process quickly and publish your work faster
- Email your paper to the corresponding journal email addresses listed on [www.iiste.org](http://www.iiste.org) with a claim that your content is original. You cannot submit your article to multiple journals at the same time.
- You will get a notification from the editor that your email has been received.
- Review comment and result will be returned. Authors may receive,
  - Publish Unaltered: the paper is ready for publication and no change is needed.
  - Acceptance after Minor Changes: you need to make minor changes according to the editor's instruction.
  - Acceptance after Major Changes: you need to make major changes according to the instruction of the editor.
  - Rejection: Manuscript is flawed or not sufficiently novel
- Submit your final article (if required) before the deadline mentioned in the acceptance letter.
- The final publication both the online and printed version of your article in the journal.

You can find more information about the journals hosted by IISTE and submission instructions on [www.iiste.org](http://www.iiste.org)

## Book Publishing Service

As little as ten years ago, releasing your work through an independent book publishing company meant your book would instantly be labelled as “vanity publishing.” This meant that you published for publishing’s sake and the quality of your writing was not a high priority. But attitudes are changing. Today, advancements in technology has shed its sullied past, emerging as a new avenue for authors to publish their works quickly.

IISTE gives authors complete access to superior publishing services—professional editorial services, excellent cover design, digital marketing, multiple sales channel, among other services—all aimed at ensuring the final product meets expectations and attracts the interest of readers and potential book buyers.

There are two options available for researchers / prospective book authors:

- **Traditional Book Publishing:** the author provides the full manuscript (normally more than 30 pages) that he/she wishes to publish. IISTE will help to revise, format and proofread the manuscript, design the cover for it and publish it in paper and electronic version in the United States. Potential readers can read it in paper, online or even on their Amazon Kindle. The book is purchasable online.
- **Book Chapter Publishing:** the author provides a book chapter (normally less than 20 pages) that he/she wishes to publish. IISTE Book Publishing Team collects and prepares book chapters from different authors under similar topics (such as Technologies, Social Sciences, Education, etc) and publish them in the United States. Same as the traditional publishing mode above, potential readers can read it in paper, online or even on their Amazon Kindle. The book is purchasable online.

You can find more information about the Book / Book Chapter publishing with IISTE and submission instructions on <http://www.iiste.org/book/>

# Vol 6, No 4 (2016)

## Table of Contents

### Articles

A Case Study of Six Land Conflicts in Bayelsa State, Nigeria <i>Etiye Mienye</i>	1-10
A Study of Sanitation Problems in Kumasi Metropolis of Ghana <i>Andrew Kwadwo Sarfo Danso</i>	11-14
Can Conservation Agriculture Technologies Mitigate Intra-Seasonal Drought Effects on Crop Yields in Steep Lands? Case of the Southern Uluguru Mountains, Tanzania <i>Ndabhemeye Mlengera, N, Peter W. Mtakwa, Baanda A. Salim, Geoffrey C. Mrema</i>	15-23
Environmental Health Behavior and Morbidity of Children in Community Settlement Brantas Riverbanks Malang <i>Budijanto., Singgih Susilo</i>	24-29
Facies Analysis and Depositional Environment of the Rus and Fil Formations (l- Eocene) in Najaf and Samawa Areas, Southern Iraq <i>Mazin Y. Tamar-Agha, Sajaa Addeb Saleh</i>	30-39
The Strategic Model of Tsunami Based in Coastal Ecotourism Development at Mandeh Regions, West Sumatera, Indonesia <i>Dedi Hermon</i>	40-45
The Significance of Honey Production for Livelihood In Ethiopia <i>Fenet Belay Daba Alemayehu Oljirra</i>	46-53
Conceptual Aspect of Hydrological Cycle in Indian Mythology of Kishkindha Kanda, Ramayana <i>Sadhana Malik</i>	54-59
Perception of Seasonal Climate Forecast Information among Smallholder Farmers in Semi-Arid Southeastern Kenya: A Case of Vei Sub-County <i>Morris M. Mwatu, Charles W. Recha, Janepha K. Kumba</i>	60-63
The Segregated City of Jos and Its Resultant Residential Property Value Pattern <i>Aliyu Ahmad Aliyu, Rozilah Kasim, David Martin, Abdu Ibrahim Garkuwa, Maryam Salihu Muhammad</i>	64-82
A New Species of Dryobalanoxylon Den Berger from the Neyveli Lignite Formation, Tamil Nadu, India <i>KUMARASAMY, D. ELAYARAJA, M.</i>	83-87
Long-Term Trend of the All-Bangladesh Summer Monsoon Rainfall, and its Association with the ENSO Index <i>Faizque Ahmed, M. Shamsul Alam, M. Matinur Rahman</i>	88-94
Changing Patterns of Ground Water Level in Fatehabad District of Haryana, India <i>Sandeep Kumar, Pooja Rani, Hardeep Rai Sharma</i>	95-98
Analysis of Rainfall Variability and Farmers' Perception towards it in Agrarian Community of Southern Ethiopia <i>Negash Wagesho Eshetu Yohannes</i>	99-107



Extract of Temu Kunci Plant ( <i>Boesenbergia Pandura</i> a Roxb) as Biolarvicida to Larvae of <i>Culex</i> and <i>Aedes Aegypti</i> <i>Marlik ., Nur Haidah, AT Diana Nerawati</i>	108-110
Environmental Impact of Trawling on the Continental Shelf of Bay of Bengal <i>Mahua Das</i>	111-127
The Effects of Land Speculation on Urban Planning and Development in Bajabure Area, Girei Local Government, Adamawa State <i>Phanuel B. Joshua, George Godwin Glanda, Felix A. Ilesanni</i>	128-133
Estimating Chlorophyll-A Concentration in a Freshwater Lake Using Landsat 8 Imagery <i>Zhiming Yang, Yolanda Anderson</i>	134-142
Technology in Disaster Management and Disaster Risk Reduction: A Review of Applications <i>V. Rathore</i>	143-145
Removal of Fluoride in Water Using Activated Carbons Prepared From Selected Agricultural Waste Materials <i>John Bentil, William Kwame Buah</i>	146-152
Assessment of the Diversity of Dung Beetles (Coleoptera, Scarabaeidae) Along a Disturbance Gradient in Udzungwa Mountain National Park, Tanzania. <i>Anna N Mwambala, B.A. Nyundo</i>	153-160
Assessing Meteorological Data for Reference Evapotranspiration in Kyela and Mbarali District <i>Wilfred Clement Kayombo, Isaya Kapakala</i>	161-167
Technology in Disaster Management and Disaster Risk Reduction: A Review of Applications <i>V. Rathore</i>	168-170

# The Strategic Model of Tsunami Based in Coastal Ecotourism Development at Mandeh Regions, West Sumatera, Indonesia

Dedi Hermon

Lecturer of Geography and Graduate Program, State University of Padang, Padang, Indonesia

## Abstract

The aim of this research is to formulate the strategic model of tsunami based in coastal ecotourism development. The danger zones of tsunami formulation was using the analytical method of Geography Information System (GIS) through GIS analysis equipment-GLOBAL MAPPER to modify and stimulate the contour through the height of tsunami's wave 10-20 m, while to formulate the danger zones of this was conducted by using GIS-ERDAS 9.1 and GIS-ArcGIS 9.1 (Hermon, 2012<sup>b</sup>, Hermon 2014<sup>c</sup>; Hermon 2015). This strategic model formulation of ecotourism development through tsunami based was conducted by A'WOT method, that is a mixture analysis of Analytical Hierarchy Process (AHP) and SWOT analysis (Kanges et al., 2001; Hermon, 2010<sup>a</sup>; Pelz, 2014; and Hermon 2014<sup>d</sup>). Generally, Mandeh regions are included in the risk zones of high tsunami and medium zones. The risk zones of high tsunami are included coastal region of Marak Island, west coastal region of Sironjong Kecil Island, north coastal region of Carocok Tarusan Bay, west, north and south coastal region of Cubadak Island, and west coastal region of Pagang peninsula. Meanwhile, the risk zones of medium tsunami are included east coastal region of Sironjong Kecil Island, east coastal region of Cubadak Island and west Sironjong Gadang, Setan Kecil and Gadang islands, Pagang islands and south coastal region of Carocok Tarusan Bay. The strategic model of tsunami based in ecotourism development showed that IFE (Internal/Strength Factor and Weaknesses Evaluation) had a score of 1,678 and EFE (External/Chance Factor and Threat) had a score of 2.371. EFE score is higher than IFE. It showed that tsunami based of ecotourism development of Mandeh regions has a big strengths and chances to be done.

**Keywords:** Ecotourism, Region, Coastal, Tsunami

## 1. Introduction

Coastal ecotourism is a marine tourism object which depended on the benefits of this region which have to have an environmental knowledge by using the principles of sustainable tourism as the priority. These principles are hoped to maintain the quality of coastal environment as well as the culture of coastal society, empower this society and give a financial benefit to all coastal society and also the government (Fandeli, *et al.*, 2005). Fennel and Eagles (1990), Damanik and Weber (2006), and Primadany (2010) explained that the richness of coastal natural resources potential can be the new and priority aim for the national development. The construction of coastal region for ecotourism development should be based on the ecosystem and culture of its society. Because of this industry is one of the resource of the regional incoming (PAD), if it is not managed well and use the environmental knowledge, can cause a serious damage of ecosystem and environment of this coastal region.

Gun (1994); Fandeli and Nurdin (2005) said that ecotourism has an important point for coastal ecosystem conservation, it is caused by several reasons such as: (1) giving an economical value for a region whose aim to have conservation in protected area, (2) giving an economical value which can be used for conservation's program in protected area, (3) increasing the income of those society who live near to the location directly or indirectly, (4) encouraging the use of natural resources continuously, and (5) reducing treats toward biodiversity.

Mandeh regions are one of the tourism objects which are located in Tarusan, Pesisir Selatan District that bounded directly to Padang City. This location has 18.000 ha included 7 villages in 3 nagari which have 9.931 society. Most of the society are farmers, stockman, and fisherman. Mandeh regions consist of Carocok Tarusan Bay, Marak, Cubadak, Setan Gadang and Kecil, Sironjong Gadang and Kecil, and also Pagang Islands. These regions have a big development potential as a coastal ecotourism. Considering that these locations have a big threat of getting Tsunami because of the big earthquake potential (>8 SR) at Siberut block (Hermon, 2012<sup>a</sup>). Tsunami is predicted to destroy Mandeh Regions and the coastal area of West Sumatera whose height 10-20 m (Hermon, 2014<sup>a</sup>). This potential need to be examined more before developing Mandeh Regions become an ecotourism object, even though this regions has a big potential and also has positive effects on economic factors for the society as well as the regional government (Hermon 2010<sup>b</sup> and Hermon 2014<sup>b</sup>). Therefore, a strategic model of tsunami based in Mandeh Regions development into an coastal ecotourism object is needed, so that the sustainability of environmental knowledge ecotourism can be realized.

## 2. Research Method

### 2.1. Spatial Model of Tsunami Risk in Mandeh Regions

This research was conducted at Mandeh Regions, Pesisir Selatan District, West Sumatera. Risk zones of tsunami

of these area are analyzed by using topography map 1:250.00 with GIS-GLOBAL MAPPER 5.1 analysis equipment to arrange contour modification and simulation for tsunami which has 10-20 m height. Meanwhile, GIS-ERDAS 9.1 and GIS-ArcGIS 9.1 (Hermon, 2012<sup>b</sup>, Hermon 2014<sup>c</sup>; Hermon 2015) are used for arranging the risk zones of tsunami.

## 2.2. Strategic Model of Tsunami Based in Coastal Ecotourism Development at Mandeh Regions

The strategic model formulation in coastal ecotourism development with systemic approach was done by using *A'WOT* (Kanges *et al.*, 2001; Hermon, 2010<sup>a</sup>; Pelz, 2014; and Hermon 2014<sup>d</sup>). *A'WOT* is a mixture analysis between AHP (Analytic Hierarchy Process) and SWOT Analysis. This analysis was done after internal factor (IFE /Internal Factor Evaluation) and external factor (EFE/ External Factor Evaluation) were arranged in tsunami based of ecotourism development so that, quality and rate of each factors are determined. Each quality is given from the most important (1.0) until the least important (0.0). After the quality is determined then the rate is known by the effect. Rate has range of values from 1-5. Rating 1 means the least influence while 5 means the most influence one.

## 3. Result and Discussion

### 3.1. Spatial Model of Tsunami Risk in Mandeh Regions

Generally, Mandeh Regions are located in a risk zone of *high* and *medium* tsunami. The risk zones of *high* tsunami are included coastal region of Marak Island, west coastal region of Sironjong Kecil Island, north coastal region of Carocok Tarusan Bay, west, north and south coastal region of Cubadak Island, and west coastal region of Pagang Peninsula. Meanwhile, the risk zones of *medium* tsunami are included east coastal region of Sironjong Kecil Island, east coastal region of Cubadak Island and west Sironjong Gadang, Setan Kecil and Setan Gadang Island, Pagang Islands and south coastal region of Carocok Tarusan Bay.

A large earthquake (M 8.8) and tsunami are likely sometime in the coming decades in West Sumatra Province, though scientists cannot predict the exact day, month, or year when this may happen. The earthquake itself would damage or destroy many existing buildings and bridges; people can protect themselves by using earthquake-resistant construction techniques for new buildings and reinforcing existing buildings. The tsunami would reach the shores of the Mentawai Islands within 5-10 minutes and would reach the mainland West Sumatran coast, including Padang and Mandeh Regions, within 20-30 minutes of the earthquake. The earthquake is likely to cause power and mobile phone networks to stop working, so warning messages may not reach the public. The sea water may or may not recede before the tsunami arrives, and would recede only a few minutes before the tsunami. This means that people living near the coast should evacuate to high ground immediately after feeling an earthquake that is strong or lasts longer than one minute. In most areas, there is not enough time to wait for official warnings or to see receding water or the tsunami itself.



Figure 1. Zone of Tsunami Risk in Mandeh Regions

A combination of paleoseismic and geodetic evidence indicates that a great earthquake (MW ~8.8) and its tsunamis are likely in the coming decades in the northern portion of the Mentawai patch of the Sunda megathrust. The potential source of this great earthquake underlies an area offshore of Mandeh Regions, around the Mentawai Islands of Siberut, Sipora, and North Pagai. Strong shaking would devastate settlements across the Mentawai Islands, Mandeh Regions, Padang, and surrounding areas near the West Sumatra coast; a tsunami, likely to be devastating in size, would reach the coastlines of the Mentawai Islands within 5-10 minutes and would reach Padang and neighboring areas of the West Sumatra coast within 20-30 minutes of the earthquake (Hermon, 2014<sup>b</sup>; EOS, 2015).

Recent local earthquakes and tsunamis have heightened local motivation for disaster risk reduction. The 2009 Padang earthquake caused extensive building damage and more than 1000 casualties. In the Mentawai Islands, nature has been a capricious teacher: the September 2007 MW 8.4 earthquake in the southern Mentawai patch generated strong shaking but a relatively small tsunami. When the October 2010 MW 7.8 earthquake generated much less shaking, it is not surprising that many people chose not to evacuate. Yet this earthquake produced a surprisingly large tsunami with maximum run-up heights of more than 16 m (Hill et al., submitted), ultimately killing 509 people and displacing some 11,425 (Mentawai Response). After one year, many survivors are still in temporary housing and struggling to re-establish their livelihoods far from their original villages (Ramsay, 2011). People throughout the Mentawai still feel this tragedy deeply: because the cultures of these isolated villages are different from one another, they feel that not only the people but also entire cultures were washed away. Their sense of shared responsibility for preventing future tragedy motivates disaster risk reduction: now is a critical time to support their efforts (EOS, 2015).

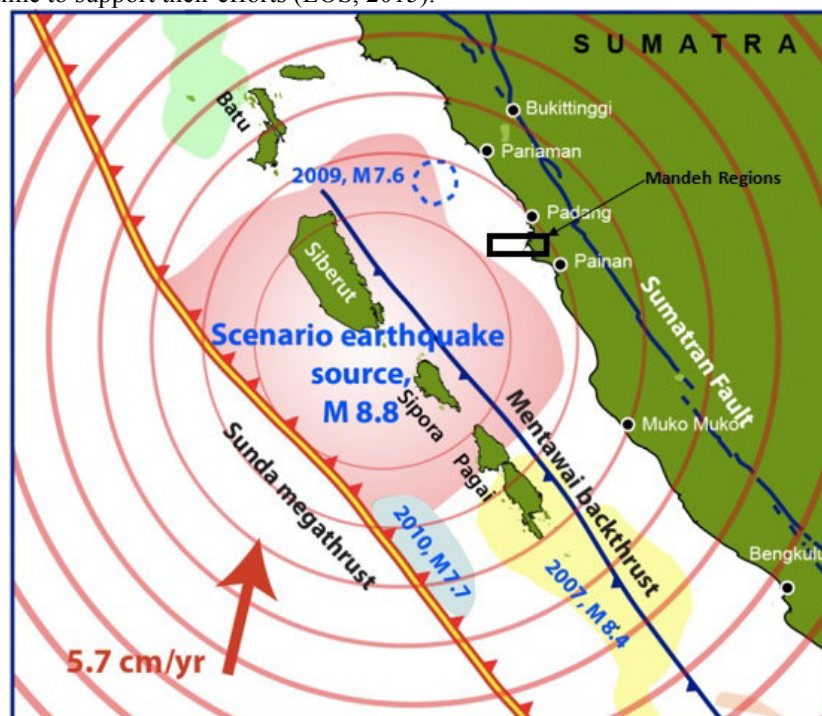


Figure 2. Earthquake Forecast on the Mentawai Patch of the Sunda Megathrust (EOS, 2015)

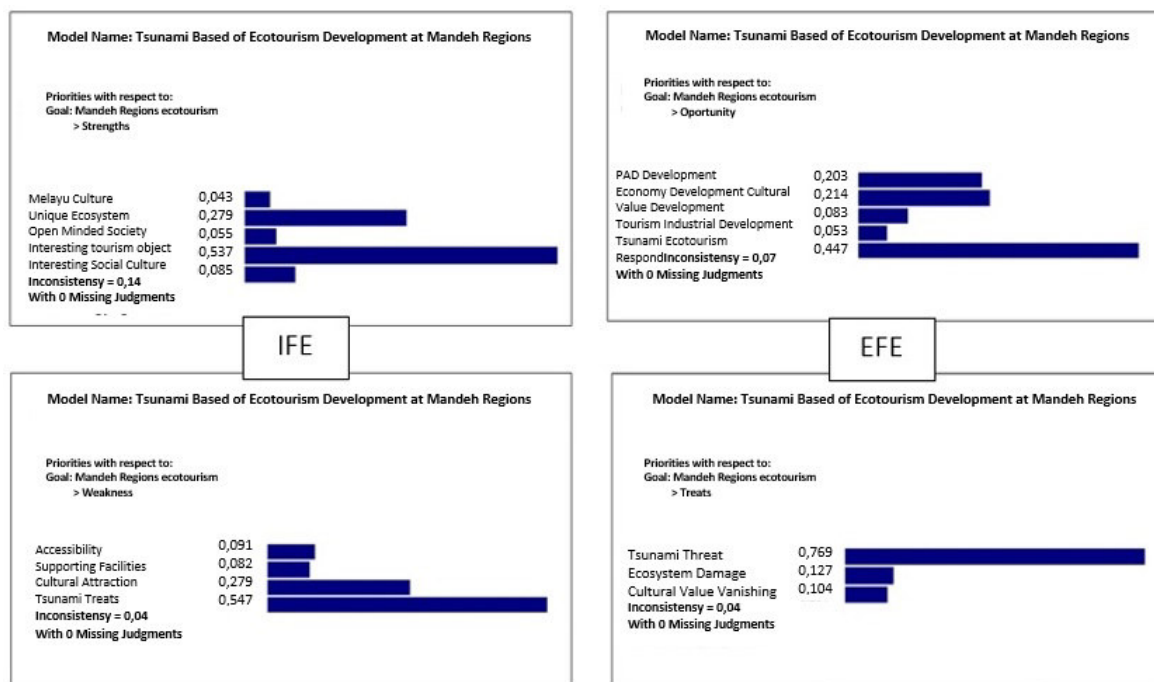
Robert *et al.*, (2010) explained that Laem Khruat, one of the rural villages in Krabi Province affected by the 2004 tsunami. The 2004 Indian Ocean tsunami devastated the Andaman Coast of Thailand. The surge killed over 8000 people and caused an estimated 32.7 million dollars in damages to fish farms. Rural villages on the coast, whose livelihoods rely on the fishing industry, suffered major economic setbacks. Many of these villages have turned to tourism to compensate for their lost income.

### 3.2. Strategic Model of Tsunami Based in Coastal Ecotourism Development at Mandeh Regions

The damage that is caused by tsunami in Mandeh Regions will be large, so that tsunami based is needed to develop ecotourism of this object in order to keep the sustainable of ecotourism and ecosystem. Analysis result of internal factor evaluation (IFE) and external factor evaluation (EFE) (Figure 2), showed that IFE gave a significant variation into each factor. In *strength* category, an interesting tourism object factor had IFE about 0,537, followed by an unique ecosystem (0,279), an interesting social culture (0,085), open minded society (0,055), and an unique melayu culture (0,043). Meanwhile, in *weakness* category, tsunami threat factor had IFE about 0,547, followed by less cultural attraction (0,279), complicated accessibility (0,091), and small amount of



facilities (0.082).



**Figure 2. IFE and EFE Score of Tsunami Based of Ecotourism Development at Mandeh Regions**

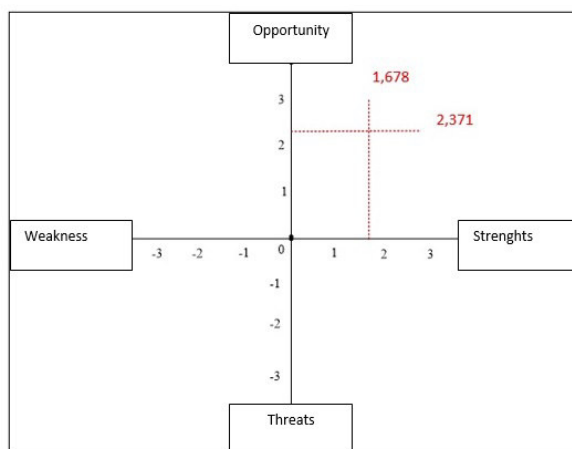
EFE score is varied for each factor where in *opportunity* category, tsunami ecotourism respond factor had the highest EFE score, that was 0.447, followed by a fast economy development (0.214), PAD development (0.023), cultural value development (0.083), and tourism industrial development (0.053). Besides that, in *threats* category, tsunami *threat* factor had the highest EFE score, which was about 0.796, followed by ecosystem damage (0.127), and cultural value vanishing (0.104).

**Table 1. Total Score IFE and EFE for Tsunami Based Ecotourism Development at Mandeh Regions**

Ecotourism Development Factors	Quality	Rating	Score
<b>A. Internal Factors (IFE)</b>			
<b>1. Strengths</b>			
a. Unique Ecosystem	0.279	5	1.395
b. Interesting Tourism Object	0.537	5	2.685
c. Open Minded Society	0.055	3	0.165
d. Interesting Social Cultute	0.085	4	0.340
e. An Unique Melayu Culture	0.043	4	0.172
<b>2. Weakness</b>			
a. Accessibility	0.091	3	0.273
b. Supporting Facilities	0.082	4	0.328
c. Cultural Attractions	0.279	3	0.837
d. Tsunami Threat	0.547	3	1.641
			<b>3.079</b>
<b>IFE Total Score</b>			<b>1.678</b>
<b>B. External Factors (EFE)</b>			
<b>1. Opportunity</b>			
a. PAD Development	0.203	4	0.812
b. Economy Development	0.214	5	1.070
c. Cultural Value Development	0.083	4	0.332
d. Tourism Industrial Development	0.053	5	0.265
e. Tsunami Ecotourism Respond	0.447	4	1.788
			<b>4.267</b>
<b>2. Threat</b>			
a. Tsunami Threat	0.796	2	1.538
b. Ecosystem Damage	0.127	2	0.254
c. Cultural Value Vanishing	0.104	1	0.104
			<b>1.896</b>
<b>EFE Total Score</b>			<b>2.371</b>

Source: Analysis Result (2016)

Analysis result showed that IFE score and EFE score are positive and EFE score (2.371) is higher than IFE score (1.678), therefore Tsunami based is needed to develop ecotourism in Mandeh Pesisir Selatan District West Sumatera. It has a big potential to be developed and improved. The relationship of IFE score and EFE score can be seen in Figure 3.



**Figure 3. Tsunami Based Ecotourism Development of Mandeh Regions Quadrant**

Having this tsunami based ecotourism development in Mandeh regions in Pesisir Selatan District West Sumatera succeeded, the efforts had been done optimally by applying an effective mitigation and adaptation patterns toward the tsunami threat. Gold (1980), Hidayati *et al.*, (2003), Dirawan (2006), Hermon (2012<sup>a</sup>), dan Hermon (2014<sup>d</sup>) explained that the sustainable management of ecotourism has the same concept as well as a sustainable development therefore, a sustainable ecotourism supposed to has these categories: (a) ecologically sustainable, which means ecotourism development does not have a negative effect toward the local ecosystem. The conservation of Ecotourism object must be conducted maximally to protect natural resources and environment from the negative effect of ecotourism activity, (b) can be accepted socially and culturally, which refers to local society ability to use ecotourism without causing any social conflicts, (c) economically, the benefits received from ecotourism activity can improve the income of local society, and (4) considering the space, it also needed to discuss the effect of a disaster toward the sustainable of this ecotourism.

#### 4. Conclusion

Mandeh regions has a big potential to be developed and improved into a coastal ecotourism object, because it has a good economic and social potential to improve the society's income. Ecotourism development of Mandeh coastal regions should consider the tsunami threat and coastal ecosystem damage. The dangerous threat of tsunami can be solved by applying an effective mitigation patterns to maximize adaptation process.

#### References

- Benyamin, I. M. (1997). "Proses Pengembangan Wisata Alam dan Dampak Lingkungan Terutama pada Aspek Sosial-Ekonomi (Studi Kasus: Pantai Bali)". Disertasi. PSL IPB. Bogor
- Damanik J, dan H.F. Weber. (2006). "Perencanaan Ekowisata, dari Teori ke Aplikasi". Pusat Studi Pariwisata (Puspar) UGM dan ANDI Press. Yogyakarta
- Dirawan G.D. (2006). "Strategi Pengembangan Ekowisata: Studi Kasus Suaka Margasatwa Mampie Lampoko". Disertasi. PSL IPB. Bogor
- Douglas R.W. (1982). "Forest Recreation". Pergamon Press Oxford University. New York.
- EOS: Earth Obseavory Singapore. (2015). West Sumatra Tectonics and Tsunami Hazard. Singapore*
- Hermon, D. (2010<sup>a</sup>). "Dinamika Permukiman dan Arahan Kebijakan Pengembangan Permukiman pada Kawasan Rawan Longsor di Kota Padang Sumatera Barat". Thesis. PSL IPB. Bogor
- Hermon, D. (2010<sup>b</sup>). "Geografi Lingkungan: Perubahan Lingkungan Global". UNP Press. Padang
- Hermon, D. (2012<sup>a</sup>). "Mitigasi Bencana Hidrometeorologi: Banjir, Longsor, Degradasi Lahan, Ekologi, Kekeringan, dan Puting Beliung". UNP Press. Padang
- Hermon, D. (2012<sup>b</sup>). "Dinamika Cadangan Karbon akibat Perubahan Tutupan Lahan untuk Permukiman di Kota Padang Sumatera Barat". J. Forum Geografi. UMS. Solo
- Hermon, D. (2014<sup>a</sup>). "Geografi Bencana Alam". Radja Grafindo. Jakarta
- Hermon, D. (2014<sup>b</sup>). "Dampak Gempa dan Isu Tsunami terhadap Dinamika Penduduk dan Perubahan Lingkungan di Kota Padang". Prosiding Seminar Internasional Serumpun. Riau-Malaysia

- Hermon, D. (2014<sup>c</sup>). "Impacts of Land Cover Change on Climate Trend in Padang Indonesia". J. International Journal Geography. UGM. Yogyakarta
- Hermon, D. (2014<sup>d</sup>). "Arahan Mitigasi Bencana Longsor Kawasan Gunung Padang Kota Padang Sumatera Barat". J. Geografi. UNP. Padang
- Hermon, D. (2014<sup>e</sup>). "Desain Kebijakan Tanggap Darurat dan Pemulihan Bencana Letusan Gunung Sinabung". Prosiding Seminar Nasional *Study and Research of Geography* 2014. Padang
- Hermon, D. (2015). "Estimates of Changes in Carbon Stocks Based on Land Cover Changes in the Leuser Ecosystem Area (LEA) Indonesia". J. Forum Geografi. UMS. Solo
- Eriyatno. (2007). "Riset Kebijakan Metode Penelitian untuk Pasca Sarjana". IPB Press. Bogor
- Eriyatno. (2012). "Ilmu Sistem Meningkatkan Mutu dan Efektifitas Manajemen". Jilid Satu Edisi Keempat. Guna Widya. Surabaya
- Eriyatno dan L. Larasati. (2013). "Ilmu Sistem. Meningkatkan Integrasi dan Koordinasi Manajemen". Jilid Dua. Edisi Pertama. Guna Widya. Surabaya
- Fandeli, D. (2000). "Pengertian dan Konsep Dasar Ekowisata". Fakultas Kehutanan Universitas Gajah Mada. Yogyakarta
- Fandeli, C dan M. Nurdin. (2005). "Pengembangan Ekowisata Berbasis Konservasi di Taman Nasional". Fakultas Kehutanan Universitas Gajah Mada. Yogyakarta
- Fennel, D and P.F.J. Eagles. (1990). "Ecotourism in Costa Rica: A Conceptual Framework". Journal of Park and Recreation Administration 8 (1): 3-34
- Gunn, C.A. (1994). "Tourism Planning: Basics, Concepts, Cases". Third Edition. London: Taylor and Francis Ltd. Washington DC
- Gold, S.M. (1980). "Recreation Planning and Design". Mac Graw Hill Book Company. New York
- Hadinoto, K. (1996). "Perencanaan Pengembangan Destinasi Pariwisata". Universitas Indonesia. Jakarta
- Marimin. (2004). "Teknik dan Aplikasi Pengambilan Keputusan Kriteria Majemuk". Grasindo. PT. Gramedia Widiasarana Indonesia. Jakarta
- Muhammadi, E. Aminullah, dan B. Susilo. (2001). "Analisis Sistem Dinamis. (Lingkungan Hidup, Sosial, Ekonomi, Manajemen)". UMJ Press. Jakarta
- Mulyaninrum. (2004). "Strategi Pengembangan Wisata Alam Berkelanjutan dalam Perspektif Ekonomi". Disertasi. Institut Pertanian Bogor. Bogor
- Pemerintah Republik Indonesia. (2009). "Undang-Undang Republik Indonesia Nomor 10 Tahun 2009 tentang Kepariwisata". Sekretariat Negara. Jakarta
- Primadany, S.R., R. Mardiyono, (2010). "Analisis Strategi Pengembangan Pariwisata Daerah (Studi pada Dinas Kebudayaan dan Pariwisata Daerah Kabupaten Nganjuk)". Jurnal Administrasi Publik. 1 (4) : 135-143
- Robert, D.A., T. Sachasiri., N. Vaccaro., M.V. Welse., A. Vargas., and N. Yongsanguanchai. (2010). "Post Tsunami Ecotourism Development: Solution for Laem Khruat Village. Chulalonghorn University
- Saragih, B and S. Satywan. (2001). "Lake Toba; The Need for an Integtraed Management System". Annual Tourism Research 23 (1): 110-121.
- Linberg K., dan D.E. Hawkins. (1993). "Ecotourisme: Petunjuk untuk Perencana dan Pengelola". The Ecotourism Society. North Bennington
- Yoeti, O.A. (2008). "Perencanaan dan Pengembangan Pariwisata". Pradaya Pratama. Jakarta
- Pelz, W. (2014). "SWOT Analyse-Definition, Beispiele, und Tipps". Institut für Management-Innovation

**Dedi Hermon (September, 24, 1974)** Born on September 24, 1974 in Padang, West Sumatra, Indonesia. Doctoral graduates of Natural Resources and Environmental Management in Bogor Agriculture University, Indonesia (2009). Worked as head irrigation projects at Pulau Punjung, West Sumatra, Indonesia (2011-2013), and as Chairman of the Disaster Research Center and Environment Padang State University (2014-2019). This time as Chairman of Geography Education Master Program at Padang State University (2003-2017). Active as a researcher of environment, disasters, and carbon stocks. The results of the study have been published in international journals