



**UNIVERSITI PUTRA MALAYSIA**

**INFLUENCE OF POST-FLOOD IMPACTS ON FARMERS' SOCIAL  
ADAPTATION LEVEL IN KELANTAN, MALAYSIA**

**MOHD HAZRAN BIN ZAHARI**

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By

**MOHD HAZRAN BIN ZAHARI**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfillment of the Requirements for the Degree of Master of Science**

**July 2018**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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**July 2018**

**Chairman : Associate Professor Norsida Man, PhD**  
**Faculty : Agriculture**

Agriculture greatly depends on climate. The climate change affects the environment condition for agriculture. Agriculture in Malaysia is not free from natural disaster especially flood. Floods disrupted agriculture community such as social, economic and environment. Kelantan state was hit by flood at the end of 2014 and affected most of Kelantan agriculture land. The flood consequently reduces agriculture production. To decrease the risks of social and economic impacts, there is a need for long-term adaptive strategies especially in agriculture community. Adaptability of community on climate change had limited capacity due to vulnerability of their locations, socioeconomic, demographic and policy on climate change. Agriculture community attitude had influenced by education, experience, family size and income that had played significant role towards post flood impacts. Thus, long-term adaptive strategies in agriculture and farmers' adaptive capacity need to be discover as preparation for future natural disaster event. These days, Malaysia lacks of research on social adaptation of farmers community in Malaysia.

The general objective this study is to identify the influence of post-flood impacts to social adaptation of farmers in Kelantan. The specific objectives of this study are: 1) to evaluate the post-flood impacts level on respondents' socio economy, agriculture activities, environment, emotion and psychology and food security; 2) to identify the respondents' level of social adaptation; 3) to investigate the relationship between socio-demographic factors and respondents' level of social adaptation; 4) to determine the relationship between the post-flood impacts level of respondents with level of social adaptation; and 5) to develop social adaptation index as indicator of farmers' social adaptation in Kelantan. The data of this study collected through the survey of 371 farmers that were 2014 flood victims in Kelantan. Questionnaires were set up to achieved objectives of this study.

Descriptive statistic results showed that most of the respondents' age is between 51-60 years old. Majority of respondents' experience in agriculture is more than 16 years. Majority of respondents earned monthly income below RM1000. Most of respondents are not received any helps and aids to restart their farms. In aspects of damages and impacts, most of the respondents perceived that their emotion and psychology and livestock or crop were the most affected. This study identified that there is no significant relationship between five (5) factors affected by post-flood impact: 1) agriculture activities; 2) socioeconomics; 3) environment; 4) emotion and psychology; and 5) local food security with the level of respondents' social adaptation. However, there were significant associations between socio demographic of respondents (age, education level and main occupation, per monthly income, type of subsector and cost of damage percentage estimation) with respondents' social adaptation level. The finding revealed that their social adaptation index is moderate level.

This study concluded that the social adaptation index level of respondents in Kelantan were moderate due to the respondents were partially resilient with the fluctuation of climate change in their places however to some region, the respondents did not affect with the flood event. Thus, this study recommended that there is a critical need to strengthen the social adaptation of farmers towards flood impacts and climate change. The strategies are encouraging the farmers to practice good preparation operation such as preparation to free livestock during flood and have a proper storage that resists from flood to reduce the impact. Other than that, extension program and activities could help the farmers to redevelop their farms again after the flood. Besides, agriculture institutes should introduce alternative crops that could regenerate income temporarily before restore their own farming.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGARUH KESAN PASCA BANJIR TERHADAP TAHAP ADAPTASI  
SOSIAL PETANI DI KELANTAN, MALAYSIA**

Oleh

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Pertanian amat bergantung kepada iklim. Perubahan iklim menjejaskan keadaan persekitaran pertanian. Pertanian di Malaysia tidak terkecuali daripada bencana alam terutama banjir. Banjir mengganggu komuniti pertanian seperti sosial, ekonomi dan alam sekitar. Negeri Kelantan telah melalui bencana banjir pada akhir 2014 dan menjejaskan kebanyakan tanah pertanian Kelantan. Banjir telah mengakibatkan pengurangan terhadap pengeluaran pertanian. Untuk mengurangkan risiko kesan sosial dan ekonomi, terdapat keperluan untuk strategi adaptasi jangka panjang terutama dalam komuniti pertanian. Keupayaan komuniti mengenai perubahan iklim mempunyai kapasiti terhad disebabkan kelemahan lokasi, sosioekonomi, demografi dan dasar mengenai perubahan iklim. Sikap komuniti pertanian telah dipengaruhi oleh pendidikan, pengalaman, saiz keluarga dan pendapatan yang memainkan peranan penting terhadap kesan banjir pasca banjir. Oleh itu, strategi adaptasi jangka panjang dalam bidang pertanian dan kapasiti adaptasi petani perlu dikenalpasti sebagai persediaan untuk bencana alam pada masa hadapan. Dewasa ini, Malaysia tidak mempunyai kurang penyelidikan mengenai adaptasi sosial.

Objektif umum kajian ini adalah untuk mengenalpasti pengaruh kesan pasca banjir kepada penyesuaian sosial petani di Kelantan. Objektif khusus kajian ini adalah: 1) menilai tahap impak pasca banjir pada ekonomi sosio responden, aktiviti pertanian, alam sekitar, emosi dan psikologi dan keselamatan makanan; 2) untuk mengenal pasti tahap penyesuaian sosial responden; 3) untuk menyiasat hubungan antara faktor sosio-demografi dan tahap penyesuaian sosial responden; 4) untuk menentukan hubungan antara tahap impak pasca banjir responden dengan tahap penyesuaian sosial; dan 5) untuk membangunkan indeks penyesuaian sosial sebagai penunjuk adaptasi sosial petani di Kelantan. Data kajian ini diambil melalui tinjauan 371

petani yang merupakan mangsa banjir 2014 bersama Sungai Kelantan. Soal selidik telah ditubuhkan untuk mencapai matlamat kajian ini.

Hasil statistik deskriptif menunjukkan bahawa kebanyakan umur responden adalah antara umur 51-60 tahun. Majoriti pengalaman responden dalam bidang pertanian melebihi 16 tahun. Majoriti responden memperolehi pendapatan bulanan di bawah RM1000. Kebanyakan responden tidak menerima sebarang bantuan untuk memulakan semula ladang mereka. Dari segi aspek ganti rugi dan kesan, kebanyakan responden menganggap bahawa 'emosi dan psikologi' dan 'ternakan atau tanaman' mereka adalah yang paling terjejas. Kebanyakan responden menghabiskan 2 hingga 5 bulan untuk memulihkan emosi dan psikologi mereka dan untuk memulakan aktiviti pertanian mereka semula. Kajian ini juga mendapati bahawa majoriti daripada responden mengalami kos kerosakan dan kerugian selepas banjir antara RM4001 dan ke atas. Kajian ini telah mengenal pasti bahawa tiada hubungan yang signifikan antara lima (5) faktor yang terjejas akibat kesan pasca banjir: 1) aktiviti pertanian; 2) sosioekonomi; 3) persekitaran; 4) emosi dan psikologi; dan 5) keselamatan makanan tempatan dengan tahap adaptasi sosial responden. Walau bagaimanapun, terdapat hubungan yang signifikan antara socio-demografi responden (umur, tahap pendidikan dan pekerjaan utama, pendapatan bulanan, jenis subsektor dan kos peratusan anggaran kerosakan) dengan tahap adaptasi sosial responden. Hasil kajian menunjukkan bahawa indeks adaptasi sosial mereka adalah tahap sederhana.

Kajian ini menyimpulkan bahawa tahap indeks adaptasi sosial responden di Kelantan adalah sederhana kerana responden sebahagiannya berdaya tahan dengan turun naiknya perubahan iklim di tempat mereka tetapi pada tahap tertentu responden tidak mengalami peristiwa banjir. Oleh itu, kajian ini mencadangkan bahawa terdapat keperluan kritikal untuk meningkatkan adaptasi sosial petani terhadap kesan banjir dan perubahan iklim. Strategi tersebut adalah menggalakkan para petani untuk mengamalkan operasi persediaan yang baik seperti persediaan melepaskan ternakan semasa banjir serta mempunyai tempat penyimpanan yang bebas banjir untuk mengurangkan kesannya. Selain itu, program dan aktiviti lanjutan boleh membantu petani untuk membangunkan semula ladang mereka selepas banjir. Malah, institut pertanian perlu memperkenalkan tanaman alternatif yang boleh meningkatkan pendapatan buat sementara waktu sebelum pemulihan ladang mereka sendiri.

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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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## LIST OF ABBREVIATIONS

11MP	11 <sup>th</sup> Malaysia Plan
CDMRC	Central Disaster Management and Relief Committee
DDMRC	District Disaster Management and Relief Committee
DID	Drainage and Irrigation Department
FAO	Food and Agriculture Organization
GDP	Gross Domestic Products
IUCN	International Union for Conservation of Nature
MJO	Madden-Julian Oscillation
MNRE	Ministry of Natural Resources and Environment
MOE	Ministry of Education
NGO	Non-Government Organization
NRE	Natural Resources and Environment
PPK	Constitution of Farmers Organisation
PWD	Public Works Department
SDMRC	State Disaster Management and Relief Committee
USD	US Dollar
WHO	World Health Organization

# CHAPTER 1

## INTRODUCTION

This chapter introduces the agricultural background in Malaysia including subsectors of plantation crop, cash crop, livestock and aquaculture. The chapter also introduces the connection between climate change, natural disaster, flood impacts and food security in Malaysia and Kelantan.

### 1.1 Agriculture in Malaysia

Agriculture has been an important sector of the national economy. Agriculture acts as the third economic growth in Malaysia. It provides essential food and fiber for humanities. Agriculture is important, as it is the main producer for human consumption such as clothes, food, rubber based, cosmetic, furniture and others.

Agriculture greatly depends on weathers caused by climate. The rising temperatures trend expected to cause various problems in this sector. Climate change threatens not only the environment for agriculture but similarly communities that are particularly those depending on the environment for their living. Therefore, the communities are in need to adapt to the climate change, especially farmers.

In 11<sup>th</sup>MP (2015) stated that the agriculture sector is expected to grow about 3.5% annually. This sector was given support through modernization by strengthening the innovation and research development in this area. According to the plan, agro-food sub-sector will be emphasized to ensure that the target level of self-sufficiency in food commodities can be achieved by the year 2020. For example, the goal of rice self-sufficiency level is set at 100%, vegetables by 95.1% and beef by 50%. On the other hand, part of agriculture sub-sector that will be in this study is oil palm sub-sector which expected to grow by 2.8% with an increase in the number of mature fields mainly in Sabah and Sarawak. Whilst, this study also includes rubber sub-sector which estimated to increase by 7.6% on expectations of a recovery in commodity prices.

### 1.2 Climate Change

Climate change indicates to shifts in the low condition of the atmosphere or its fluctuation, continuing for an extended period (decades or more). Climate change might be because of natural changes or to persistent anthropogenic variations in the arrangement of the climate or land utilize. Malaysia experiences a tropical climate weathers that undergo the South-West and the North-East Monsoon seasons. However, Malaysia privileged with precious natural resources and adequate amount

of rainfall consistently. In any case, Malaysia is not free from any natural disaster. As per studies, the most noteworthy natural disaster in Malaysia is flood (DID, 2001). Floods are typical hydrological phenomena in Malaysia, by and large influencing a range of 29,000 km<sup>2</sup>, more than 4.82 million individuals (22% of the population) and incurring yearly harm of USD298.29 million (Asian Disaster Reduction Center, 2005). The global climate is without a doubt changing, and the evidence is mounting.

The climate change has influenced food production, land use and survival of plants and animal species. Malaysia and the South-East Asia district are not saved by the impact of climate change that encountered serious flooding. The impacts of climate change are being felt in Malaysia. Inconsistent climate brings about unpredictable rainfall patterns and Malaysia has encountered sudden unexpected prolonged droughts. This has created water stress in the region. Flash floods and heavy floods have brought about billions of Ringgits of losses both economy and human lives. With no comprehensive water request and resources administration set up in Malaysia, the increase of flood intensity and frequency would bring extra costs on water resources management because of the necessities toward adjustment for flood mitigation plans (Low and Ahmad Jamaluddin, 2001).

### **1.2.1 Adapting to Climate Change**

In adapting the impacts of climate change, water resources and agriculture sector has been the focus. Almost one million people have been protected from floods through the implementation of 194 flood mitigation projects. In addition, 34 maps of dangerous areas have been developed to assist in the planning of development in high-risk areas and disaster prevention. Coastal erosion prevention efforts have been implemented to protect and restore coastal areas from further erosion. In this case, 24.4 kilometers of coastal areas in Johor, Kelantan, Penang, Sabah, Sarawak, Selangor and Terengganu have been restored.

National Water Resources Policy was launched in 2012 to provide direction and strategy in water resource management, including improving governance in ensuring the security and sustainability of water resources. Apart from building resilience against floods or prolonged drought, a new strategy to improve food security was introduced. A new aerobic rice variety, known as MR1A1 was launched in 2013. The rice has resistance to high temperatures and requires less water, allowing it to be grown in areas with water shortages, and the off-season of rice cultivation. The aerobic rice was expected to increase rice production and at the same time have the potential to adapt to climate change (11<sup>th</sup>MP, 2015).

Hamdan (2013) in his paper stated that to measure farmers' adaptive capacity seen as a wise step, to assist various parties as information of the farmers' strengths and weaknesses to formulate strategies that needed and compulsory for farmers.

### 1.2.2 Effects of Climate Change on Agriculture Sector

The impact of climate change touches several sectors in Malaysia mainly agriculture, forestry, public health, energy sector and water and coastal resources. Agriculture is one of the sectors highly affected by extreme climate change. The consequences of climate change could reduce crop yield. The areas that vulnerable to floods could easily affect towards cultivation activities. Therefore, the impacts pose a threat to national food security. Consequences of climate change would promote to an increase of the magnitudes of the rainfall that will result in an increase in the frequency of floods and flood damage that in turn will effect to agriculture activities and economy.

As indicated by Siwar (2009), the climate change impacts on agriculture sustainability are various. He explained that the impact on agricultural crops in Malaysia administers by the timing of the physiological process, the rate of spreading out and survival-reproductive structures and evaporation function because of climate change. Climate change relied upon to bring about long-term water and other resource deficiencies additionally, which would worsen soil condition, disease and pest outbreaks on livestock and crops. Vulnerable zones experience losses in agriculture productivity, for the most part, because of decreases in product yields and furthermore, it would give ultimate impact towards poor farmers.

The sustainability of food security could also affect by climate change. Other than that, the changing of climate affects the agriculture industry. Based on agricultural cycle such as rubber plantations, increasing in rainfall is not safe for rubber. Rubber plantations could hurt due to loss of tapping days and crop washouts. Whilst other crops such as oil palm could flourish with higher rainfall. However, excessive rainfall is unfavorable as yield is significantly affected. The production of crude palm oil would decrease.

The recent studies by WHO, (2003); Lemmen and Warren, (2004); Haines et al. (2006); Ebi et al. (2006) and Confalonieri, et al. (2007) in their studies collected that the actual and virtual vulnerability to climate change depends on various factors and future projections, major of them are as follows:

- 1) economic development condition
- 2) income level and distribution
- 3) food availability
- 4) population density
- 5) local environmental condition
- 6) geographical position
- 7) quality and availability of public health care provision.



Thus, the occurrence of natural disaster due to extreme climate change especially floods could influence negative outcome on the economy, social and psychology of the people affected.

### **1.3 Natural Disaster**

Climate change elevates to a natural disaster that disturbs human activities. A natural disaster is the consequence of the synthesis of a human activities and natural risk. Risk vulnerability that brought on by the absence of appropriate administration prompts to financial, human injury and structural. Malaysia is blessed free from natural disaster, for example, earthquake, typhoon, and earthquake. Nonetheless, the most serious natural disaster suffered in Malaysia is flood.

#### **1.3.1 Flood**

Overall in Malaysia, including Sabah and Sarawak, there is about 189 river basins (89 of the river basins are in Peninsula Malaysia, while 78 in Sabah and 22 in Sarawak) are disposed to flood. An estimated area exposed to flood disaster is about 9% or roughly 29,800 km<sup>2</sup> of the total Malaysia areas. The vulnerability could interrupt very approximately 22% of the Malaysian population.

The reason Malaysia is exposed to flood risks is associated with nature of Malaysia and human activities in the area. Human activities, for example, the development of building in that areas are not well plan, uncontrolled building and large land-utilize changes could lead to flood. Chan (1998b) stated that human factors and natural atmosphere formed different type of disaster, for example, floods, monsoon rainfall, and tidal. Others than that, inappropriate administration for flood mitigation leads to extreme floods.

Flood happens because of water inundations from riverbanks and overrides the bordering plain. Typically, flood happens when heavy rainfall happened in a continuous period of a few days at a specific area. Erikson (1971) characterize flood is a circumstance where water streams surpass the conveying limit of a river bringing on in floods over the riverbanks.

#### **1.3.2 Flood Scenario in Malaysia**

There are two (2) types of flood often occurred in Malaysia. The two types of floods happen are monsoon flood and flash flood. The monsoon flood happens generally for the reason that Northeast Monsoon prevails from November to March with extensive rains toward the East Coast states of the Malaysia Peninsula such as Kelantan, Pahang and Terengganu. While flash flood come about because of heavy rainfall and human made structure due to run off. Terengganu experiences heavy

rainfall during the Northeast monsoon that happens between October and March. The rainfall leads to serious floods. Terengganu situated on the east shore of Peninsular Malaysia. The floods that happen was because of the combination of elevation and its place nearby the sea.

MNRE (2007a) describes floods occurrence began when the Northeast monsoon brought a heavy rainfall through continuing storms until caused destructive flood specifically in Kota Tinggi, Johor. The flood in Kota Tinggi strike consequently of two waves, the December 2006 that kept going for 13 days from 19 – 31 December, and January 2007 went on for 7 days from 12 – 17 January. The flood was harmful with the highest water level recorded achieved 2.75 m, is the largest amount ever recorded since 1950 and it brought about more than 100,000 individuals to be cleared and the death of 18 individuals recorded.

From the scenario flood in Malaysia, heavy flood risks are usually cause by monsoon rainfall. However, the reason of monsoon alone is not strong enough as monsoon is accountable that leads to floods. Human factors also cause the flood and by that reason, it caused heavier risks and damages into areas that prone to floods. In Table 1.1 below shows varies of flood history in Malaysia, including the lost and the fatality rate.

**Table 1.1 : Floods History in Malaysia**

<b>Date/Year</b>	<b>Incidence</b>	<b>USD Losses</b>	<b>Number of Deaths</b>
December 1996	Floods brought by Tropical Storm Greg in Keningau (Sabah State)	300 million	241
December 2006 & January 2007	Floods in Johor State	489 million	18
2008	Floods in Johor State	21.19 Million	28
2010	Floods in Kedah and Perlis	8.48 Million (Aid alone)	4

(Source : Chan 2012)

### **1.3.3 Flood Disaster in Kelantan**

Flood happened from 15 December 2014 – 3 January 2015 called as the extreme floods in decades. National Security Council (2014) informed that Kelantan had the most evacuees with an estimation of 20,468 to 24,765 individuals, trailed by different states in Malaysia as appeared in the Table 1.2 below. The figure below illustrates a much clearer outlook of the affected areas in Malaysia. Because of this, numerous organizations and business affected.

**Table 1.2 : Total Evacuees in States affected by 2014 Flood**

<b>States</b>	<b>Total Evacuees</b>
Kelantan	20,468 - 24,765
Terengganu	21, 606
Pahang	10,825
Perak	1,030
Sabah	336
Negeri Sembilan	350
Johor	300
Perlis	143
Kedah	51

(Source : National Security Council 2014)

Table 1.3 shows the chronology of 2014 flood event specifically in Kelantan states and districts. According to Shamsuddin (2016), he detailed that the manifestation of heavy rainfall in southern Kelantan in December 2014 were connected with natural phenomenon called Madden-Julian Oscillation (MJO). High pressure in the Pacific Ocean, strong easterly wind from the Indian Ocean had carry a tremendous measure of moisture blew into Peninsular Malaysia. When it met the strong westerly wind from the Pacific Ocean approaching from the opposite direction, remarkable high rainfall happened that brought the huge flood. He detailed that the rainfall recorded at Gunung Gagau, Gua Musang, Kelantan amid December 15-24, 2014 period was 1986 mm which signifies around two-third of the annual rainfall in the area.

**Table 1.3 : The 2014 Flood Events**

<b>Flood Chronology</b>	
15-17 December 2014	First wave of heavy rainfall at the north area of Kelantan
18 December 2014	First wave of the flood at Rantau Panjang, Pasir Mas, Pasir Puteh, and Bachok.
19-20 December 2014	The first wave of flood starts declined.
21-24 December 2014	Heavy rainfall on Orange and Red level at Hulu Kelantan, the heaviest rainfall was stated at Gunung Gagau on 22 and 23 December (478 mm, 515 m).
22 December 2014	Floods start to rise rapidly at Gua Musang and Kuala Krai from night hour.
22-23 December 2014	Bandar Gua Musang sank almost 85%. Dangerous level was recorded at Dabong (48.89 m) and Tualang (40.67 m)
24 December 2014	Almost the whole city of Kuala Krai is paralyzed. Water begins to overflow in the area of Tanah Merah, Pasir Mas, and Kota Bharu.
24 December 2014	Overflow warning issued by the State Flood Disaster Committee, which will have an impact of flooding along the riverbank in Kota Bharu district.
25 December 2014	In Kota Bharu, floods began to rise sharply as early as 5 am. The river began to be sunk by the flood. The highest danger level at Jambatan Diraja (6.8 m).
28 December 2014	Floods began to recede gradually in all areas because rains were stopped.
29-31 December 2014	Floods had receded completely, but some evacuation centers were still opened at Gua Musang, Kuala Krai, Tanah Merah and Machang because the people involved lost property.

(Source : Kelantan Strategic Studies Centre, 2014)

There are also severe damages because of the end of 2014 flood in Malaysia. Table 1.5 is the cost of damages according to the states affected by 2014 flood alone. From the table, the total cost of damages is RM337.6 million that cause government allocation disturbance.

**Table 1.4 : Cost of Damages according to States (2014)**

No.	States	Cost of Damages (RM)
1.	Kelantan Pahang Terengganu	204 Million
2.	Johor Melaka Negeri Sembilan	78 Million
3.	Perak Kedah Perlis	55.6 Million
<b>Total</b>		<b>337.6 Million</b>

(Source : PWD, 2015)

Akasah (2015) concluded that an appropriate restoration plan with a right management system and a potential team must advance in building up the envisioned goal. However, in the aim to restore the damages after the flood, they need to realize and understand that those areas environment are vulnerable to any disaster.

In order to have a proper management system specifically in agriculture sector, there must be a measurement to identify farmers' social adaptation capacity. The capacity is necessary for the future planning and management among farmers to restart agriculture activities and economic growth.

#### **1.4 Social Adaptation**

Agriculture sector threatens with various factors came from human and environment. Human factor such as declining numbers of farmer community and shifting off farm of the young generation had restricted the growth of agriculture sector. Furthermore, agriculture sector vulnerable towards environmental factor that exposed toward natural disaster due to climate change consequences especially floods disaster in Malaysia. Social adaptation of community in agriculture sector is important for the survival of this sector.

Generally, social adaptation defines the adjustment of community or society had to overcome or adapt with external stress that is natural disaster such as flood, drought and typhoon (Smit, 2006). He also stated that social adaptation sometimes can be defining as adaptive capacity of community have been go through to be in a good condition than before after affected by external stress. The element of social adaptation exists as a normal response of human behaviour to minimize the impact when stress happen. The social adaptation also can come about accordance to interpersonal with society, their social behaviour, and the cultural norms that usually had in the community (Buss, 1996).

In aspect of psychological perspective, social adaptation also correlated with the on-going process of individual that attached in the emotions and intellect (Kahle, 1985). The on-going process is subsequent of human to balance their mental and their emotional states to interact with their social and cultural environments. The individuals are restricted to express and live accordance of their environments and cultural. While, Peleg (2012) defines that social adaptation is a state of adjustment of an individual or a social group with their environment to favour their existence and growth.

There are many studies about flood impact in agriculture sector. Most of the studies tend to prove that flood has negative impacts in agriculture sector (Nelson, 2009). While, Saqib (2016) proves that flood impacts are the main reasons of low yields and crop production due to the risk and uncertainty. The risk of flood impact can be efficiently decrease by having long-term adaptive strategies in agriculture (Fuhrer, 2006). Morton (2007) said that adaptive capacity towards climate change depends depend on their locations and from various of socioeconomic, demographic, and policy. Studies show that without social adaptation, climate change is largely problematic for agricultural production, economies and communities. On the other hand, with social adaptation, vulnerability can be reduced (Smit, 2002). Malla (2009) suggested that the time has arrived to discover farmers' adaptive measures to mitigate the impacts.

## **1.5 Problem Statement**

Kelantan state was hit by heavy flood at the end of 2014. The flood in Kelantan at the end of 2014 was the worst flood ever after since flood event in 1926. Consequently, the disaster was disturbing community activities in Kelantan. This disaster had been given negative impact to society, economic growth, physiological and environmental to the people of Kelantan. To be emphasized, agriculture and natural resources sectors are highly risked to be affected because these sectors vulnerable to a natural disaster.

However, Malaysia is not suffering from any highly hazardous natural disaster such as typhoon, earthquake and volcanic eruptions. In Malaysia, flood is a common disaster that disturbs the activities of Malaysian in areas that prone to flood disaster. To be focused, the area that highly vulnerable to flood is agriculture areas. Kelantan has various agriculture subsectors such as plantation crop, cash crop, aquaculture and livestock. Most of agriculture land in Kelantan affected by heavy flood at the end of 2014. Farmers were suffered from the impact of the flood. Their properties and belongings were also destroyed by this flood.

There were many studies about flood impact in agriculture sector. Dinh (2012) and Nelson (2009) revealed that flood has negative impacts in agriculture. Agriculture depends on complex interactions between the atmosphere, biosphere and

hydrological cycle (Falloon and Betts, 2010). These complex interactions had been given significant impacts and consequently reduce agriculture production. Saarnak (2003) in his study supported that the inundation of river had affect the yield recession. While, Saqib (2016) studied that flood impacts are the main reasons of low yields and crop production due to the risk and uncertainty. Khan et al. (2014) elaborated that there are direct and indirect flood impacts. He mentioned that the direct impacts are damages triggered by the physical contact of floodwaters with commodities while, the indirect impacts are disrupting to the community such as household, social, economic and location characteristics.

Adaptation has abundance of literature review as stated by Bahinipati and Venkatachalam (2015); Ashraf and Routray (2013). Very little discussion on social adaptation of farmers in Malaysia specifically. Only few researchers have focused their main investigations on the social adaptation of community due to impacts of climate change (Azril et al., 2013). Whereby the common aspects of social adaptation are not under their radar. Therefore, this study aims to fill this gap by further research on social adaptation.

## **1.6 Research Questions**

Research questions for this study:

- 1) What is the post-flood impacts level on respondents' socio economy, agriculture activities, environment, emotion and psychology and food security?
- 2) What is the respondents' level of social adaptation?
- 3) What is the relationship between socio-demographic factors and respondents' level of social adaptation?
- 4) What is the relationship between the post-flood impacts level of respondents with level of social adaptation?
- 5) What is the social adaptation index as indicator of farmers' social adaptation in Kelantan?

## **1.7 Objective of the Study**

### **1.7.1 General Objective**

The general objective of this study is to identify the influence of post-flood impacts to social adaptation of farmers in Kelantan.

### 1.7.2 Specific Objectives

The specific objectives are:

- 1) to evaluate the post-flood impacts level on respondents' socio economy, agriculture activities, environment, emotion and psychology and food security;
- 2) to identify the respondents' level of social adaptation;
- 3) to investigate the relationship between socio-demographic factors and respondents' level of social adaptation;
- 4) to determine the relationship between the post-flood impacts level of respondents with level of social adaptation; and
- 5) to develop social adaptation index as indicator of farmers' social adaptation in Kelantan.

### 1.8 Significance of Study

This study was conducted to the farmers at flood-affected areas in Kelantan involving four subsectors that include plantation crop, cash crop, aquaculture, and livestock. Malaysia specifically Kelantan is commonly affected by flood disaster. Kelantan community have to face the flood almost every year compared to Terengganu, Pahang, Johor and Kedah, Sabah and Sarawak.

Floods and other natural disasters have to be managed holistically as it gives enormous impact, economically, socially and psychologically to both people and nation. Floods could as well affect the sustainability of food supply and food security of the nation. The consequence of climate change such as floods on agriculture sector lead this study to measure social adaptation of farmers for the purpose of management and reduce the impacts of floods and climate change.

Therefore, social adaptation index was developed to act as an indicator to identify farmers' social adaptation capacity towards flood. The index could help the communities to be well prepared in many ways. The social adaptation index could be used for agriculture agencies as well as publics officials and local planners in order to prepare and respond to any emergency events.

Other than that, the index could also help several levels of related agencies to make decision in order to understand the requirement needed to assist the farmers and agriculture sector as a whole. The index could benefit other related parties in doing the best plan to evacuate the farmer communities from any post flood impact obstacles to restore their farming activities.



Nevertheless, the results of this study could as well to identify communities who need continuous support in order to recover from flood impact for their agriculture needs. Last but not least, the policy makers and the agricultural agencies could also use the finding to comes out with formulation and strategies to ensure proper management for flood victims in Kelantan including to support food security for both economic and social stability.

## **1.9 Thesis Organization**

There are five chapters describe part of this study. Chapter 1 is the introduction that covers the knowledge and information about the core agriculture in Malaysia. Besides, the problem statement of this study, the objectives and significant of the study also include in this chapter.

In Chapter 2, the literature reviews is the compilation of previous related studies that quoted and added to give better information about this study.

Chapter 3 will provide the method of the studies. In this chapter, the location of the study, respondent selection, source of the information, questionnaire design, and the analysis technique are discussed.

Chapter 4 is one of the important that shows the results of the analyzed data and the explanation.

Lastly, Chapter 5 will conclude the summary of findings, recommendation for future study and the limitation of the study.

## REFERENCES

- 11<sup>th</sup> Malaysia Plan (2015). Retrieved from <http://rmk11.epu.gov.my/index.php/bm/>
- Adger, W. N. (1999). Social vulnerability to climate change and extremes in coastal Vietnam. *World development*, 27(2), 249-269.
- Adger, W. N. (2006). Vulnerability. *Global Environmental Change*. 16, 268-281.
- Akasah, Z. A., & Doraisamy, S. V. (2015). 2014 Malaysia flood: impacts and factors contributing towards the restoration of damages. *Journal Of Scientific Research and Development*. 2(14), 53-59.
- Ali, R. Solis, C. Omoronyia, I. Salehie, M. and Nuseibeh, B. (2012). "Social adaptation: when software gives users a voice". In: ENASE 2012: 7th International Conference Evaluation of Novel Approaches to Software Engineering, 28-30 June 2012, Wroclaw, Poland.
- Allison, E. H. and Ellis, F. (2001). The livelihoods approach and management of small-scale fisheries. *Marine policy*, 25(5), 377-388.
- Allison, H. and Hobbs, R. (2004). Resilience, adaptive capacity, and the "Lock-in Trap" of the Western Australian agricultural region. *Ecology and society*, 9(1).
- Armah, F. A., Yawson, D. O., Yengoh, G. T., Odoi, J. O. & Afrifa, E. K. (2010). Impact of floods on livelihoods and vulnerability of natural resource dependent communities in Northern Ghana. *Water*, 2(2), 120-139
- Ashraf, M. & Routray, J. K. (2013). Perception and understanding of drought and coping strategies of farming households in north-west Balochistan. *International Journal of Disaster Risk Reduction*, 5, 49-60.
- Asian Disaster Reduction Centre. (2005), Mitigation and Management of Flood Disasters in Malaysia. Kobe: Asian Disaster Reduction Centre. Available from:  
[http://www.adrc.asia/publications/TDRM2005/TDRM\\_Good\\_Practices / PDF/ PDF-005e/Chapter3\\_3.3.6.pdf](http://www.adrc.asia/publications/TDRM2005/TDRM_Good_Practices/PDF/PDF-005e/Chapter3_3.3.6.pdf).
- Azril, M. S. H., et al. (2013). The process of social adaptation towards climate change among Malaysian fishermen. *International Journal of Climate Change Strategies and Management*, 5(1), 38-53.
- Baharuddin, M. K. (2007). Climate Change—Its effects on the agricultural sector in Malaysia. In *National seminar on socio-economic impacts of extreme weather and climate change* (pp. 21-22).

- Bahinipati, C. S. & Venkatachalam, L. (2015). What drives farmers to adopt farm-level adaptation practices to climate extremes: Empirical evidence from Odisha, India. *International Journal of Disaster Risk Reduction*, 14, 347-356.
- Barnes, T. J., Hayter, R. and Hay, E. (1999). " Too young to retire, too bloody old to work": Forest industry restructuring and community response in Port Alberni, British Columbia. *The Forestry Chronicle*, 75(5), 781-787.
- Bass, R. (1998). Evaluating environmental justice under the national environmental policy act. *Environmental Impact Assessment Review*, 18(1), 83-92.
- Becker, H. S. and Carper, J. (1956). The elements of identification with an occupation. *American Sociological Review*, 21(3), 341-348.
- Bennett, K. (2001). *Voicing power: women, family farming and patriarchal webs*. Centre for Rural Economy, Department of Agricultural Economics and Food Marketing, University of Newcastle upon Tyne.
- Benson, C., Twigg, J., & Rossetto, T. (2007). *Tools for mainstreaming disaster risk reduction: guidance notes for development organisations*. ProVention Consortium.
- Bernama. (2015, January 19). Banjir: Sektor pertanian Kelantan rugi RM105 juta. Utusan Online. Retrieved from <http://www.utusan.com.my/berita/nasional/banjir-sektor-pertanian-kelantan-rugi-rm105-juta-1.49642#nav-allsections>
- Bliss, J. C., Walkingstick, T. L. and Bailey, C. (1998). Development or dependency? Sustaining Alabama's forest communities. *Journal of Forestry*, 96(3), 24-30.
- Boer, H. and Seydel, E. R. (1996). Protection motivation theory. In *M. Connor and P. Norman (Eds.) Predicting Health Behavior*. Buckingham: Open University Press.
- Bohle, H. G., Downing, T. E., & Watts, M. J. (1994). Climate change and social vulnerability: toward a sociology and geography of food insecurity. *Global environmental change*, 4(1), 37-48.
- Brooks, N. (2003). Vulnerability, risk and adaptation: A conceptual framework. *Tyndall Centre for Climate Change Research Working Paper*, 38, 1-16.
- Brunckhorst, D. J. (2002). Institutions to sustain ecological and social systems. *Ecological Management & Restoration*, 3(2), 108-116.
- Burton, I., Kates, R. W. and White, G. F. (1993) *The Environment as Hazard*. 2nd edn. Guilford Press, New York.

- Buss, D. M. (1996). Social adaptation and five major factors of personality. In J. S. Wiggins (Ed.), *The five-factor model of personality: Theoretical perspectives* (pp. 180-207). New York, NY, US: Guilford Press.
- Carroll, M. S. and Lee, R. G. (1990). Occupational community and identity among Pacific Northwestern loggers: implications for adapting to economic changes. *Community and forestry: Continuities in the sociology of natural resources*, 141-155.
- Cernea, M. M. (1993). The Sociologist's Approach to Sustainable Development. *Finance and Development* 30, 1-7.
- Chambers, R. (1989). Editorial introduction: vulnerability, coping and policy. *IDS bulletin*, 20(2), 1-7.
- Chan, N. W. (1995), *A Contextual Analysis of Flood Hazard Management in Peninsular Malaysia*, Ph.D. Middlesex University (UK).
- Chan, N. W. (2012). 'Impacts of Disasters and Disasters Risk Management in Malaysia: The Case of Floods', in Sawada, Y. and S. Oum (eds.), *Economic and Welfare Impacts of Disasters in East Asia and Policy Responses*. ERIA Research Project Report 2011-8, Jakarta: ERIA. pp. 503-551.
- Cinner, J. (2005). Socioeconomic factors influencing customary marine tenure in the Indo-Pacific. *Ecology and society*, 10(1).
- Cochrane, K. L. (2000). Reconciling Sustainability, Economic Efficiency and Equity in Fisheries: The One That Got Away. *Fish and Fisheries* 1, 3-21.
- Colding, J., Elmqvist, T., & Olsson, P. (2003). Living with disturbance: building resilience in social-ecological systems. *Navigating social-ecological systems: building resilience for complexity and change*, 163-185.
- Confalonieri, U., Menne, B., Akhtar, R., Ebi, K. L., Hauengue, M., Kovats, R. S. and Woodward, A. J. (2007). Human health. *Climate change 2007: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*.
- Dardak, R. A. (2015). Transformation of Agricultural Sector in Malaysia Through Agricultural Policy. *Malaysian Agricultural Research and Development Institute (MARDI), Malaysia*, 7.
- Dasgupta, P., & Mäler, K. G. (2001). *Wealth as a criterion for sustainable development*. Beijer international institute of ecological economics.
- Denevan, W. M. (1983). Adaptation, variation, and cultural geography. *The Professional Geographer*, 35(4), 399-407.

- Dilley, M. (2000). Reducing vulnerability to climate variability in Southern Africa: the growing role of climate information. In *Societal Adaptation to Climate Variability and Change* (pp. 63-73). Springer, Dordrecht.
- Dinh, Q., et al. (2012). Climate change impact on flood hazard, vulnerability and risk of the Long Xuyen Quadrangle in the Mekong Delta. *International journal of river basin management*, 10(1), 103-120.
- Dobzhansky, T. (1968). On some fundamental concepts of Darwinian biology. In *Evolutionary biology* (pp. 1-34). Springer, Boston, MA.
- Downing, T. E. (1991) *Assessing socioeconomic vulnerability to famine: Frameworks, concepts and applications*. Research Report 91-1, World Hunger Program, Brown University, Providence RI.
- Ebi, K. L., Kovats, R. S. and Menne, B. (2006). An approach for assessing human health vulnerability and public health interventions to adapt to climate change. *Environmental health perspectives*, 114(12), 1930-1934.
- Erikson, N. J. (1971). Human adjustment to flood in New Zealand. *Applied Geography*, 27(2), 21-32.
- Falloon, P. & Betts, R. (2010). Climate impacts on European agriculture and water management in the context of adaptation and mitigation—the importance of an integrated approach. *Science of the Total Environment*, 408(23), 5667-5687.
- FAO (2016). The State of World Fisheries and Aquaculture 2016. Contributing to food security and nutrition for all. Rome. 200 pp. <http://www.fao.org/3/a-i5555e.pdf>
- Fenton, D. M. (2004). Framework Development: Indicators of Capacity, Performance and Change in Regional NRM Bodies. Socio-economic Indicators for NRM: Project 1.1. *Land and Water Resources Research and Development Corporation, Canberra*.
- Fisher, D. R. (2001). Resource Dependency and Rural Poverty: Rural Areas in the United States and Japan. *Rural Sociology* 66, 181-202.
- Food and Agriculture Organization (2002), 'The State of Food Insecurity in the World 2001', Rome, <http://ftp.fao.org/docrep/fao/003/y1500e/y1500e00.pdf>
- Freudenberg, W. R., Frickel, S. (1994). Digging Deeper: Mining- Dependent Regions in Historical Perspective. *Rural Sociology* 59, 266-288.
- Fuhrer, J., et al. (2006). Climate risks and their impact on agriculture and forests in Switzerland. In *Climate Variability, Predictability and Climate Risks* (pp. 79-102). Springer Netherlands.

- Gonzalez, J. J. and Benito, C. G. (2001). Profession and Identity. The Case of Family Farming in Spain. *Sociologia Ruralis* 41, 343-356.
- Green, R. (1999). Meaning and Form in Community Perception of Town Character. *Journal of Environmental Psychology* 19, 311-329.
- Habegger, B. (2008). "Risk Management in Public Policy". International Studies Association 49th Annual Convention San Francisco, USA.
- Haines, A., Kovats, R. S., Campbell-Lendrum, D. and Corvalán, C. (2006). Climate change and human health: impacts, vulnerability and public health. *Public health*, 120(7), 585-596.
- Hallegatte, S. and Przyluski, V. (2010). *The economics of natural disasters: concepts and methods*. World Bank Policy Research Working Paper Series, Vol.
- Haller, T. (2002). *The Understanding of Institutions and their Link to Resource Management from New Institutionalism Perspective*. Zurich.
- Hamdan, M. E., Man, N., Yassin, S. M., D'Silva, J. L. and Shaffril, H. M. (2013). Farmers' adaptive capacity towards the impacts of global warming: a review. *Asian Social Science*, 9(13), 177.
- Harris, C. C., W. J. McLaughlin, and G. Brown. 1998. Rural communities in the interior Columbia basin: How resilient are they? *Journal of Forestry* 96(3):11-15
- Hassan, A. J. and Ghani, A. A. (2006). Development of risk map using GIS for Sg. Selangor Basin. Retrieved on 4th. January, 2015 from <http://www.redac.eng.usm.my.html>
- Hidalgo, M. C., Hernandez, B. (2001). Place Attachment: Conceptual and Empirical Questions. *Journal of Environmental Psychology* 21, 273-281.
- Hofferth, S. L., Iceland, J. (1998). Social Capital in Rural and Urban Communities. *Rural Sociology* 63, 574-598.
- Howden, S. M., Soussana, J., Tubiello, F. N., Chhetri, N., Dunlop, M., Meinke, H. (2007). Adapting Agriculture to Climate Change. *Proceedings of the National Academy of Sciences* 104, 19691-19696.  
[http://www.met.gov.my/files/ClimateChange2007/session1b/K220Hussaini\\_p.doc](http://www.met.gov.my/files/ClimateChange2007/session1b/K220Hussaini_p.doc).
- Hughes, E. C. (1958). *'Men and Their Work.'* (Free Press: Glencoe).
- Humphrey, C. R. (1994). Introduction: Natural Resource-Dependent Communities and Persistent Rural Poverty in the U.S. -Part II. *Society and Natural Resources* 7, 201-203.

- Hussain, T. P. R. S. and Ismail, H. (2011). Land use changes analysis for Kelantan Basin using spatial matrix technique "Patch Analyst" in relation to flood disaster. *Journal of Techno-Social*, 3(1).
- Hussain, T. P. R. S., Nor, A. R. M. and Ismail, H. (2014). The level of satisfaction towards flood management system in Kelantan, Malaysia. *Pertanika Journal of Social Science and Humanities*, 22(1), 257-269.
- IPCC (2007). 'Climate Change 2007 - Impacts, Adaptation and Vulnerability - Contributions of Working Group II to the Fourth Assessment Report of the International Panel on Climate Change'. (Cambridge University Press: Cambridge).
- Islam, K. N. (2006). *Impacts of flood in urban Bangladesh: micro and macro level analysis*. AH Development Publishing House.
- Israel, D. C., & Briones, R. M. (2012). *Impacts of natural disasters on agriculture, food security, and natural resources and environment in the Philippines (No. 2012-36)*. PIDS discussion paper series.
- Johnson, T. G, Stallman, J. I. (1994). Human Capital Investment in Resource-Dominated Economies. *Society and Natural Resources* 7, 221-223.
- Kahle, L. R., & Homer, P. M. (1985). Physical attractiveness of the celebrity endorser: A social adaptation perspective. *Journal of consumer research*, 11(4), 954-961.
- Kechik, I. B. A. (1995). Aquaculture in Malaysia. In *Towards sustainable aquaculture in Southeast Asia and Japan: Proceedings of the Seminar-Workshop on Aquaculture Development in Southeast Asia, Iloilo City, Philippines, 26-28 July, 1994* (pp. 125-135). SEAFDEC Aquaculture Department.
- Kelantan Strategic Studies Centre, (2014). *Banjir Kelantan 2014 - Satu Muhasabah*. Kelantan State Government.
- Khan, M. M. A., Shaari, N. A. B., Bahar, A. M. A., Baten, M. A., & Nazaruddin, D. A. B. (2014). Flood impact assessment in Kota Bharu, Malaysia: a statistical analysis. *World Applied Sciences Journal*, 32(4), 626-634.
- King, L. A., Hood, V. L. (1999). *Ecosystem Health and Sustainable Communities*. *Ecosystem Health* 5, 49-57.
- Kurien, J. (2004). Responsible Fish Trade and Food Security: Toward understanding the relationship between international fish trade and food security. *Rome: Food and Agriculture Organization, and Royal Norwegian Ministry of Foreign Affairs*.

- Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*. New York: McGraw-Hill.
- Lemmen, D. S. and Warren, F. J. (2004). Climate change impacts and adaptation: a Canadian perspective.
- Leventhal, H. (1970). Findings and theory in the study of fear communications. In L. Berkowitz (ed.) *Advances in Experimental Social Psychology*, 5. New York: *Academic Press*, 119-86.
- Lindell, M. K. and Prater, C. S. (2003). Assessing community impacts of natural disasters. *Natural Hazards Review Volume 4(4)*, pp. 176-185.
- Low, K.S. and Ahmad Jamaluddin, S. (2001) Assessment of the impacts of climate change on key economic sectors in Malaysia: Water resources. In Chong, A.L. and Mathew, P. (eds): *Malaysia national response strategies to climate change*. Ministry of Science, Technology and Environment.
- Malla, G. (2009). Climate change and its impact on Nepalese agriculture. *Journal of agriculture and environment*, 9, 62-71.
- Marshall, N. A. (2007). Can Policy Perception Influence Social Resilience to Policy Change? *Fisheries Research* 86:216-227.
- Marshall, N. A. (2010). *A conceptual and operational understanding of social resilience: Insights for optimising social and environmental outcomes in the management of Queensland's commercial fishing industry*. VDM Publishing.
- Marshall, N. A. (2010). Understanding social resilience to climate variability in primary enterprises and industries. *Global Environmental Change*, 20(1), 36-43.
- Marshall, N. A., Marshall, P. A., Tamelander, J., Obura, D., Malleret-King, D. and Cinner, J. E. (2010). *A Framework for Social Adaptation to Climate Change: Sustaining Tropical Coastal Communities and Industries*. IUCN.
- Marshall, N., Marshall, P. and Abdulla, A. (2009). Using social resilience and resource dependency to increase the effectiveness of marine conservation initiatives in Salum, Egypt. *Journal of Environmental Planning and Management*, 52(7), 901-918.
- Mazess, R. B. (1975). Biological adaptation: aptitudes and acclimatization. *Biosocial interrelations in population adaptation*, 9-18.
- McCutcheon, F. H. (1964). 'Organ systems in adaptation: the respiratory system', in *Handbook of Physiology*, volume four: Adaptation to the environment. Edited by D. B. Dill, E. F. Adolph, and C. G. Wilber, 167-191. Washington, D. C.: American Physiological Society.



- Messner, F. (2007). *Evaluating flood damages: guidance and recommendations on principles and methods*. Helmholtz Umweltforschungszentrum (UFZ).
- Milbrath, L. W. (1995). Psychological, cultural, and informational barriers to sustainability. *Journal of Social Issues*, 51(4), 101-120.
- Ministry of Natural Resources & Environment (MNRE). (2007a). Flood and Drought Management in Malaysia.
- Minnegal, M., King, T. F., Just, R., Dwyer, P. D. (2004). Deep Identity, Shallow Time: Sustaining a Future in Victorian Fishing Communities. *The Australian Journal of Anthropology* 14, 53-71.
- Morton, J. F. (2007). The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the national academy of sciences*, 104(50), 19680-19685.
- National Agro-food Policy 2011-2020, (2011). Retrived on 22th December 2016 at <http://www.moa.gov.my/dasar-agromakanan-negara-2011-2020-dan>
- National Security Council, (2014, December 25<sup>th</sup>). "Situation continues to worsen in badly-hit Kelantan and Terengganu". The Star.
- National Security Council (2011). Laporan Kesiapsiagaan Bencana Semasa Monsun Timur Laut. Malaysia.
- Nelson, G. C., et al. (2009). *Climate change: Impact on agriculture and costs of adaptation* (Vol. 21). International Food Policy Resources Institute.
- Nord, M. (1994). Natural resources and persistent rural poverty: In search of the nexus. *Society & Natural Resources*, 7(3), 205-220.
- Ogburn, W. F. (1972). Fixity and Persistence in Society. In '*Social Change*'. (Ed. R Nisbet) pp. 46-72. (Basil Blackwell Publishers: Oxford).
- Olsson, P., Folke, C., Berkes, F. (2004). Adaptive Co-management for Building Resilience in Social-Ecological Systems. *Environmental Management* 34, 75-90.
- Overdeest, C. and Green, G. P. (1995). Forest Dependence and Community Well-Being: A Segmented Market Approach. *Society and Natural Resources* 8, 111-131.
- Parker, D., & Hewitt, K. (1998). *Regions of Risk: A Geographical Introduction to Disasters*.
- Peleg, O. (2012). Social anxiety and social adaptation among adolescents at three age levels. *Social Psychology of Education*, 15(2), 207-218.

- Peluso, N. L., Humphrey, C. R. and Fortmann, L. P. (1994). The rock, the beach, and the tidal pool: People and poverty in natural resource-dependent areas. *Society & Natural Resources*, 7(1), 23-38.
- Poggie, J. J. and Gersuny, C. (1974). *Fishermen of Galilee*. University of Rhode Island.
- Public Works Department of Kelantan, (2015). Report on Flood Damages.
- Public Works Department, (2015). Malaysian Flood Rehabilitation.
- Re, S. (1998). Floods-an insurable risk. *Zurich Swiss Reinsurance Company*. Retrieved from <http://www.unisdr.org/partners/countries>
- Reed, M. G. (1999). "Jobs Talk": Retreating from the Social Sustainability of Forestry Communities. *The Forestry Chronicle* 75, 755-763.
- Rickson, R. E., Western, J. S. and Burdge, R. J. (1990). Social impact assessment: knowledge and development. *Environmental Impact Assessment Review*, 10(1-2), 1-10.
- Ritchie, J. W., Abawi, G. Y., Dutta, S. C., Harris, T. R., Bange, M. (2004). Risk management strategies using seasonal climate forecasting in irrigated cotton production: a tale of stochastic dominance. *Australian Journal of Agricultural & Resource Economics* 48, 65-93.
- Rogers, R. W. (1983). Cognitive and psychological processes in fear appeals and attitude change: A revised theory of protection motivation. *Social psychophysiology: A sourcebook*, 153-176.
- Rosa, E. A. (1998). "Metatheoretical foundations for post-normal risk". *Journal of Risk Research Volume 1*, pp. 15-44.
- Saarnak, N. L. (2003). Flood recession agriculture in the Senegal River Valley. *Geografisk Tidsskrift-Danish Journal of Geography*, 103(1), 99-113.
- Saegert, S., & Winkel, G. H. (1990). Environmental psychology. *Annual review of psychology*, 41(1), 441-477.
- Salaman, G. (1974). Community and occupation: An exploration of work/leisure relationships (No. 4). CUP Archive.
- Saqib, S. E. et al. (2016). An empirical assessment of farmers' risk attitudes in flood-prone areas of Pakistan. *International Journal of Disaster Risk Reduction*, 18, 107-114.
- Scoones, I. (1999). New Ecology and the Social Sciences: What Prospects for a Fruitful Engagement? *Annual Review of Anthropology* 28, 479-507.

- Shamshuddin, J., et al. (2016). Effects of December 2014 Great Flood on the Physico-Chemical Properties of the Soils in the Kelantan Plains, Malaysia. *Journal of Water Resource and Protection* 8(02), 263.
- Sivakumar, M. V. (2005). Impacts of natural disasters in agriculture, rangeland and forestry: an overview. In *Natural disasters and extreme events in Agriculture* (pp. 1-22). Springer, Berlin, Heidelberg.
- Siwar, C., Alam, M. M., Murad, M. W. and Al-Amin, A. Q. (2009). A review of the linkages between climate change, agricultural sustainability and poverty in Malaysia. *International Review of Business Research Papers*, 5(6), 309-321.
- Skidmore, M., & Toya, H. (2005). *Economic Development and the Impacts of Natural Disasters* (No. 05-04).
- Smit, B. and Pilifosova, O. (2003). From adaptation to adaptive capacity and vulnerability reduction. *Climate change, adaptive capacity and development*, 9-28.
- Smit, B. and Skinner, M. W. (2002). Adaptation options in agriculture to climate change: A typology. *Mitigation and Adaptation for Global Change*, 7 (UNFCCC 1992), 85-114.
- Smit, B. and Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global environmental change*, 16(3), 282-292.
- Sorenson, R. L, Kaye, K. (1999). Conflict Management Strategies Used in Successful Family Businesses. *Family Business Review* 12, 133.
- Stedman, R. C. (1999). Sense of Place as an Indicator of Community Sustainability. *The Forestry Chronicle* 75, 765-770.
- Steinfeld, J. I. (2001). Climate change and energy options: decision making in the midst of uncertainty. *Fuel Processing Technology* 71, 121-129.
- Taylor, C. R. (2003). The role of risk versus the role of uncertainty in economic systems. *Agricultural Systems* 75, 251-264.
- Twigger-Ross, C. L. and Uzzell, D. L. (1996). Place and Identity Processes. *Journal of Environmental Psychology* 16, 205-220.
- WHO (2003). "Methods of Assessing Human Health Vulnerability and Public Health Adaptation to Climate Change", Series No. 1: Health and Global Environmental Change. WHO Regional Office for Europe, Denmark.
- Wu, Y. et. al. (2005). Protection motivation theory and adolescent drug trafficking: relationship between health motivation and longitudinal risk involvement. *Journal of pediatric psychology*, 30(2), 127-137.

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