



UNIVERSITI PUTRA MALAYSIA

***PUBLIC PERCEPTION OF PROTECTED FORESTED WATERSHED
AREA IN CAMERON HIGHLANDS, MALAYSIA***

ARLIXCYA VINNISA ANAK EMPIDI

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**PUBLIC PERCEPTION OF PROTECTED FORESTED WATERSHED AREA
IN CAMERON HIGHLANDS, MALAYSIA**

By

ARLIXCYA VINNISA ANAK EMPIDI

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

November 2020

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

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November 2020

Chairman: Diana Emang, PhD
Faculty : Forestry and Environment

Intensive land-use changes are increasing in Cameron Highlands. Not only it caused massive forest conversion and land degradation, but it also poses significant environmental threats that could deteriorate the source of water resource, i.e., the forested watershed areas. The protection initiative can help in reducing the impact of land-use change and subsequently address environmental threats that undermine the sustainability of the forested watershed areas. The general objective of this study is to determine publics' behavioural intention towards the protection initiatives for forested watershed areas in Cameron Highlands. The Theory of Planned Behaviour (TPB) was adapted to measure the determinants of publics' behavioural intention. Hence the specific objectives are: (i) to examine the direct effect of TPB constructs (i.e., attitude, subjective norm, and perceived behavioural control) on public intentions towards the protection initiatives for forested watershed areas, and (ii) to investigate direct and indirect effects from external variables with the TPB constructs. Data collection employed the systematic random sampling and involved the face-to-face survey interview with 143 respondents in Ringlet, Tanah Rata, Brinchang, Terla and Tringkap of Cameron Highlands. The statistical analysis of Spearman's rho correlation and multiple regressions analysis are applied in estimating the behavioural intention. The finding of this study shows the significant direct effect of attitude, in which the public have positive attitudes towards the protection initiatives for the forested watershed areas in Cameron Highlands. The direct effect of social norm also visible, where there are significant social pressures placed upon the public from their social circles, regarding their intention to participate in the protection initiatives. In the aspect of indirect effect, significant results of several pro-environmental behaviours show the essence of public behavioural beliefs and control beliefs that represent the intention of the public to participate in the protection initiatives. These pro-environmental behaviours include support conservation campaign, agreement on watershed conservation funds, belief in the good management of fertilisers and pesticides, attending sustainable agriculture

practice seminars and accepting the improvement of manure plan. The other aspect of indirect effect such as the motivation to comply with the normative referents remains low, even though it is significant in influencing public intention. In general, the findings of this study indicate that attitude, subjective norms, and perceived behavioural control are significant predictors in examining the intention of the public to participate in the protection initiatives for forested watershed areas in Cameron Highlands. This study enriches the literature of TPB constructs in the context of forestry, through the understanding of publics' perspective in protecting a critically important natural resource from the forest. It also provides timely and informative insights that will help government and relevant organisations to understand publics' intention in protection initiatives. Consequently, it also could increase the involvement of the public in activities that safeguarding the forested watershed areas.



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

PERSEPSI ORANG AWAM TERHADAP KAWASAN TADAHAN HUTAN YANG DILIDUNGI DI CAMERON HIGHLANDS, MALAYSIA

Oleh

ARLIXCYA VINNISA ANAK EMPIDI

November 2020

Pengerusi: Diana Emang, PhD
Fakulti : Perhutanan dan Alam Sekitar

Perubahan penggunaan tanah secara intensif semakin meningkat di Tanah Tinggi Cameron. Bukan hanya ia menyebabkan penukaran hutan secara besar-besaran dan degradasi tanah, tetapi juga menimbulkan ancaman persekitaran yang besar dan merosakkan sumber air, iaitu kawasan tadahan hutan. Inisiatif perlindungan dapat membantu mengurangkan kesan perubahan penggunaan tanah dan seterusnya menangani ancaman alam sekitar yang menggugat kelestarian kawasan tadahan hutan. Objektif umum kajian ini adalah untuk menentukan niat tingkah laku masyarakat terhadap inisiatif perlindungan untuk kawasan tadahan hutan di Cameron Highlands. *Theory of Planned Behaviour* (TPB) diadaptasi untuk mengukur niat tingkah laku masyarakat. Oleh itu objektif khusus adalah: (i) untuk mengkaji kesan langsung binaan TPB (i.e., sikap, norma subjektif, dan kawalan tingkah laku yang disifatkan) terhadap niat masyarakat dalam inisiatif perlindungan untuk kawasan tadahan hutan, dan (ii) untuk menyiasat kesan langsung dan tidak langsung daripada pemboleh ubah luaran TPB. Pengumpulan data menggunakan persampelan rawak yang sistematik dan melibatkan temuramah secara bersemuka dengan 143 responden di Ringlet, Tanah Rata, Brinchang, Terla dan Tringkap di Cameron Highlands. Analisis statistik korelasi *Spearman rho* dan analisis regresi berganda telah digunakan dalam menganggarkan niat tingkah laku. Penemuan kajian ini menunjukkan kesan langsung yang signifikan bagi sikap, di mana masyarakat mempunyai sikap positif terhadap inisiatif perlindungan untuk kawasan tadahan hutan di Cameron Highlands. Kesan langsung norma sosial juga ketara, di mana terdapat tekanan sosial yang besar daripada lingkungan sosial oleh masyarakat, berkenaan niat mereka untuk mengambil bahagian dalam inisiatif perlindungan. Dalam aspek kesan secara tidak langsung, keputusan yang signifikan dari beberapa tingkah laku pro-alam sekitar memperlihatkan intipati kepercayaan tingkah laku dan kawalan yang mewakili niat masyarakat untuk mengambil bahagian dalam inisiatif perlindungan. Tingkah laku pro-alam sekitar ini merangkumi sokongan kepada kempen pemuliharaan, persetujuan terhadap dana pemuliharaan kawasan tadahan hutan, kepercayaan terhadap pengurusan baja dan racun perosak yang baik, menghadiri seminar amalan pertanian lestari dan

menerima penambahbaikan rancangan pembajaan. Aspek kesan secara tidaklangsung yang lain seperti motivasi untuk mematuhi dengan rujukan norma kekal rendah, walaupun ia penting dalam mempengaruhi niat masyarakat. Secara umum, penemuan kajian ini menunjukkan bahawa sikap, norma subjektif dan kawalan tingkah laku yang disifatkan adalah peramal penting dalam menentukan niat masyarakat untuk menyertai inisiatif perlindungan untuk kawasan tadahan hutan di Cameron Highlands. Kajian ini memperkayakan sastera binaan TPB dalam konteks perhutanan, melalui pemahaman terhadap perspektif masyarakat dalam melindungi sumber semulajadi yang sangat penting dari hutan. Ini juga memberikan pandangan yang bertepatan dan bermaklumat untuk membantu kerajaan dan organisasi yang berkaitan dalam memahami niat masyarakat dalam inisiatif perlindungan. Seterusnya, ia juga dapat meningkatkan penglibatan orang ramai dalam kegiatan melindungi kawasan tadahan hutan.



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

Diana Emang, PhD

Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Chairman)

Norhisham Ahmad Razi, PhD

Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 11 March 2021

Declaration by graduate student

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LIST OF ABBREVIATIONS

ha	hectare
a.s.l	Above sea level
m	Metre
BI	Behavioural Intention
A	Attitude
SN	Subjective Norm
PBC	Perceived Behavioural Control
MEA	Millennium Ecosystem Assessment
MyGAP	Malaysian certification scheme for Good Agricultural Practices
DOA	Department of Agriculture
FAO	Food and Agriculture Organization
WWF	World Wild Fund for Nature

CHAPTER 1

INTRODUCTION

1.1 Background of study

Water is crucial to human survival, and its scarcity will jeopardise the quality of human life. Water conservation has become a top priority in many governmental policies around the world to ensure efficient water management and sustainability of water resources to the public (Wahid & Hooi, 2015). Sustainability in water supply for public consumption is closely linked with the conservation of water sources, in particular the forested watershed areas.

The forested watershed areas serve as sites for interlinked hydrological processes, including the evaporation, transpiration, and infiltration (Lal, 1999). It covered with plant communities that improve water quality and regulate stream flows and reduce flood damages. It supplies a multitude of ecosystem services to human wellbeing including purification and preservation of drinking water quality, maintenance of habitat for both aquatic and terrestrial species, protection of landscapes, and flood control (Brauman et al., 2007; de Groot et al., 2010; Hein et al., 2006; MEA- Millennium Ecosystem Assessment, 2005; Postel & Thompson, 2005). Plant communities within watershed areas play a central role in abiotic processes ranging from precipitation and interception to sediment deposition and nutrient retention (Brauman et al., 2007; Calder, 2007; Jose, 2009; Neary et al., 2009; Ong & Swallow, 2003).

The forested watershed areas also act the natural infrastructure with function to collects water from rainfall, store various amounts of water at different times and releases water as runoff. Many forested watershed areas comprised of forests in mountainous areas with streams and rivers that all flow into a single larger body of water. In such areas, its riparian area serves as the “living filters” where is absorbs sediments and redefine the pollutants before discharge drinking water sources. Forests in this area have a role in soaking up stormwater and provide shade for streams, which can protect the aquatic life organisms. These areas also absorb water from rainfall and discharge the water at maximum capacity after precipitation falls. Hydrological services of the forest in this upstream area are essential for flood mitigation and water purification to the local household and industries at the downstream area (Larsen, 2017; MEA, 2006).

Acknowledging these hydrological services from a healthy forested watershed area, many countries have strengthened their forest conservation programs such as the watershed-payment programs (Brauman et al., 2007; Kinzig et al., 2011). As of 2011, there are approximately 150 watershed-payment programs in the developing countries, in which the program compensates landowners for not cutting their forests in order to keep it as watershed area (Bennet et al., 2013). The

implementation of the programs highlighted that the forested watershed areas as an important water catchments area that not only essential to the water cycle and supply water to the general population but also provide habitat for myriad species of wildlife and fish.

Although all of these are the significant contributions of the forested watershed areas to human welfare and in supporting the ecological process, there are always concerns about its sustainability. The concerns are due to the degradation of the forested watershed areas produced by natural phenomena and human activities. Their combination produces greater degradation of the forested watershed areas, hence resulting in severe upland and downstream impacts (Vargas et al., 2019). The impacts of human activities often surpass the degradation effects from natural phenomena due to enormous land-use demands from people in the uplands and downstream communities. The natural phenomena such as the geologic instability, high-intensity and long-duration rainfall, steep river gradients, shallow soils on steep slopes and fire rarely happened. However, human actively caused widespread damages of the forested watershed areas through the conversion of forests to agriculture lands that are increasing illegal encroachment, uncontrolled land-use changes, and inappropriate farming practices (FAO-Food and Agriculture Organization, 2003).

Forest conversion for agricultural areas is predominantly causing adverse impacts on water quality and quantity due to the negative effect of soil erosion from croplands, discharge of the fertiliser and manure and generation of wastewater (Erol & Randhir, 2013; Gunawardhana et al., 2016; Huang et al., 2016). To an extent, this land-use change degrading the ecological structure and functions of the source of water, i.e. the forested watershed areas, and therefore, negatively affect the chain of supply of its ecosystem services (Brauman et al., 2007; Smartt et al., 2013). Land-use changes affected forest and therefore, posed an immediate long-term impact on the structure of the forested watershed areas (Calder, 2000; Hack et al., 2013; Lee et al., 2009).

In Malaysia, water resources are abundance due to high amount of rainfall, but risks on the sustainability of water resources due to the destruction and degradation of forested water catchments exists (WWF-World Wild Fund for Nature Malaysia, 2017). Although the forested watershed areas are a source of water for drinking, agriculture, and industry (Larsen, 2017) and protected under the National Forestry Act 1984 due to their important role in providing ecosystem services that supporting human livelihood, deforestation and forest encroachment for illegal agriculture farms have caused many adverse impacts on forested water catchments areas in this country. These threats have caused a detrimental effect on water quality and reduce the water quantity in water reservoirs (see The Star, 2014; Free Malaysia Today, 2012).

Watersheds covered with natural forest covers provide a better water quality than watershed with other land uses (Knee & Encalada, 2014) and water quality parameters usually have a positive correlation with the proportion of forest cover

(Huang et al., 2016). Therefore, the protection measures for the forested watershed area are urgently needed to minimise the loss of its ecosystem services. Better management and conservation measures could protect the sustainability of these forested areas as it is a critical source that supplies high-quality water for domestic, agricultural, industrial and ecological needs (FAO, 2017).

In this regard, this study focuses on the forested watershed areas in Cameron Highlands, Pahang. The forested watershed areas in Cameron Highlands cover three primary water catchments namely, Telom catchment in the north, Bertam catchment in the middle, and Lemoi catchment in the south. There are 123 tributaries which linked to these three main rivers that function as small watershed areas (Kumaran & Ainuddin, 2006). This area is also linked with the Jelai and Pahang rivers, where both rivers flow through the state of Pahang, in which the Pahang river drains into the South China Sea (Ariff, 2009). As it is a high-altitude area, the forested watershed areas in Cameron Highlands support ecological services and supplies water through all these rivers to the downstream users. It comprises of water supply for hydroelectric power, agriculture irrigation, domestic consumption, and recreational use (Van der Ent & Termeer, 2005).

The intricacies of this area as a source of water, in terms of its geographical characters and its capacity in reaching users within a vast area reflect the level of its importance in being an environmentally sensitive resource that crucial for human livelihood and ecological process, hence justify the selection of this area as the study site. As such, environmental threats that could deteriorate the source of water resource have the merit for further investigation as all these threats could affect the wellbeing and livelihood of the communities.

1.2 Problem statements

Forested watershed areas of Cameron Highlands are parts of the forests within the Main Range of Peninsular Malaysia. This area is located at high altitudes, at approximately 1 829m above sea level, covering 71 218hectares (ha) of forests which predominantly covered by the upper dipterocarp, lower montane and upper montane forests (Ibrahim, 2004). The forested watershed areas ranged from forest reserves in Ulu Telom, the forest areas near Ringlet, Brinchang and Tanah Rata towns, to the mountain peaks and ridgetops of Brinchang, Jasar, Perdah, Berembun, Mentigi, Siku and Irau. The area receives the annual average rainfall not less than 2 000mm, and its relative humidity is between 70% and 90% (Mohamad & Chow, 2003). Coupled with a high precipitation level and various elevations and slope patterns, these forested areas not only served as the watersheds but also act as the water catchment areas.

Despite their ecological importance to the wealth and welfare of the human population, this area faces threats due to intense land-use changes. Although more than 38 000 ha of forests in Cameron Highlands declared as the Permanent Forest Reserve, approximately 532ha of these forests have been actively encroached

(Forestry Department of Pahang, 2019). Hence, it has threatened the sustainability of forested watershed areas in providing ecosystem services to support human livelihood. Forest encroachment is common for opening illegal agriculture farms, hence is recognised as one of the intense land-use changes that threaten the sustainability of forested watershed areas (Razali et al., 2018; Weng & Mokhtar, 2011).

Forest encroachment at river reserve areas for agricultural purposes also has diminished the water bodies from 237ha in 1984 to 177ha in 2002 (Gasim et al., 2009). In particular, there is a significant land-use change in riverbanks and at Bertam and Telom catchment areas, in which it strongly correlates with the increment of vegetable farming and urban development (Rozimah & Khairulmaini, 2016). There is also a 3% increase in the reduction of forest covers in 2015 due to the intense development of agricultural activities (Razali et al., 2018). In the previous years of 1997 to 2014, the land-use patterns in Cameron Highlands have revealed that there is an approximately 8% reduction in forest and wetland areas (Rendana et al., 2015). Observation forests and natural areas from 1996 to 2015 also indicate there is 13% loss, a decrease in the forests and natural area covers from 67 381ha to 58 855ha (Rozimah & Khairulmaini, 2016).

All these anthropogenic activities significantly threatened the sustainability of the forested watershed areas. Hence, it raises a need for protection initiatives that could help policymakers and resources managers to identify appropriate environmental measures that could minimise adverse impacts from intense land-use changes on forested watershed areas in Cameron Highlands. Laws and policies related to forest management have been used, at the state and federal government levels, respectively. It aimed to intervene in forest encroachments and exercise stronger control on other intense land-use changes. For example, there is an establishment of a task force on forest land issues (see The Star, 2019) and limitation in the cultivation areas in Cameron Highlands (see New Straits Times, 2019).

To complement efforts from state and federal governments, public participation is required to understand publics' behavioural intention towards the protection initiatives on forested watershed areas. Members of the public are a crucial stakeholder in the management of water resources. Public participation could harness the potential of local citizens to address environmental issues which are difficult to overcome using the 'top-down' type of directives (Andersson et al., 2008). The approach involving public participation could increase public awareness of the environmental issues, optimising public's knowledge, and experiences regarding the specific environmental issue, as well as encouraging public involvement and acceptance of transparent decision-making processes (European Commission, EC, 2003).

Considering these advantages, this study examines the behavioural intention of the public¹ towards the protection initiatives of the forested watershed areas in Cameron Highlands. It is examined using the psychological constructs consisting of attitudes (A), subjective norm (SN) and perceived behavioural control (PBC), which are derived from the well-established Theory of Planned Behaviour (TPB) framework. This TPB framework is relevant as there is a lack of information on the intention of human behaviour, from the point of view of the protection initiative for forested watershed areas. In particular, little is known about the direct and indirect effects via attitude, norm, and perceived behavioural control on the intention to participate in the protection initiative for forested watershed areas. Using the TPB framework, it demonstrates that the public behavioural intention towards the protection initiatives of the forested watershed areas which could be addressed using the following research questions:

- i. How would they carry out protection initiatives (i.e., attitude)?
- ii. How would they perceive social pressure placed upon them (i.e., subjective norm)?
- iii. How they would recognise their capability to perform the behaviour (i.e. perceived behavioural control) that suitable for protecting forested watershed areas?

1.3 Research objectives

The general objective of this study is to determine publics' behavioural intention towards the protection initiatives for forested watershed areas in Cameron Highlands using the Theory of Planned Behaviour. The specific objectives are:

- i. To examine the direct effect of TPB constructs (i.e., attitude, subjective norm, and perceived behavioural control) on public intentions towards the protection initiatives for forested watershed areas.
- ii. To investigate direct and indirect effects from external variables with the TPB constructs on public intentions towards the protection initiatives for forested watershed areas.

1.4 Research justification

The present study attempts to fill the research gap by incorporating the Theory of Planned Behaviour in understanding publics' behavioural intention towards the protection initiatives for forested watershed areas in Cameron Highlands. Firstly, this study examines the public's attitude, subjective norm, and perceived behavioural control factors concerning the protection initiatives for forested

¹Throughout this thesis, the term 'public' and 'the respondents' will be used interchangeably.

watershed areas in Cameron Highlands. In addition to this, the study also explores publics' beliefs and normative pressure they have regarding the protection initiatives of the forested watershed areas.

Hence, this study will enhance the understanding on psychological constructs consisting of attitude, subjective norm, and perceived behavioural control, including publics' beliefs, and associated normative pressure and ultimately summarise the behavioural intention of public towards the protection initiatives for forested watershed areas in Cameron Highlands.

The findings provide important insight from the public in regard to the protection initiatives for forested watershed areas. It also could serve as a benchmark to evaluate strategies for protection initiatives of the critically sensitive environments. This study also fills the gap of the limited research on forested watershed protection initiatives based on the TPB framework in Malaysia. It highlights the importance of investigating the psychological constructs of the public in order to give timely information regarding the protection initiatives for forested watershed areas. As such, public intention reflects their values and concerns towards the forested watershed protection, which can be disseminated to relevant governmental institutions. The information can be further incorporated into decisions that could positively affect the livelihood of the public as they are the primary users and beneficiaries of forested watershed areas and also could guide relevant local government agencies in protecting the forested watershed areas in Cameron Highlands.

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BIODATA OF STUDENT

ArlixcyaVinnisa Anak Empidi was born on 17 June 1994 in Bintulu, Sarawak. She enrolled for her primary school at SK Kampung Baru, Bintulu in 2001 and attended secondary school for 5 years (2007-2011) in SMK Bintulu, Sarawak. She then studied at Labuan Matriculation College and took Biology Chemistry course (Module 3) for one year (2012-2013). After that, she continued her study in bachelor's degree of Forestry Science at Universiti Putra Malaysia and graduated in 2017. In 2018, she is pursuing her master's degree in Master of Science in Forest Management and Ecosystem Science at Faculty of Forestry and Environment, Universiti Putra Malaysia (Serdang Campus).



LIST OF PUBLICATIONS

- Empidi, A.V.A. & Emang, D. (2020). Public perception of forested watershed protection initiatives: The case of Cameron Highlands. *The Malaysian Forester*, 83(1), 73-83.
- Zaki, N. A. M., Empidi, A.V. A. & Emang, D. (2020). Household Dependency on Mangrove Forest in Kuala Sepetang, Perak, Peninsular Malaysia. *The Malaysian Forester*, 83(2), 158-177.





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