UNIVERSITI TEKNOLOGI MARA

APPLICATION OF ^{137}Cs TECHNIQUE FOR STUDYING SOIL EROSION IN AGRICULTURAL FARMLAND, CAMERON HIGHLANDS, PAHANG, MALAYSIA

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Applied Sciences

January 2015

CHAPTER ONE
INTRODUCTION

1.1 PREAMBLE

The introduction of overall contents in this study will represent in this chap. It was firstly with the topic of background of the study followed with the problem statement and significant of the study. At the next topic was the objective of the research and lastly the scope and limitation of the study.

1.2 BACKGROUND OF RESEARCH

Soil erosion is a major environmental concern in agricultural practice, especially on the hilly and agricultural land (Li et al., 2009). It is widely recognized that deterioration of the soil resource will affect the sustainability of the entire agro ecosystems (Navas et al., 2005). Results from soil erosion were not only degrade at the on-site but also off-site troubles occur related to downstream sedimentation plus surface and ground water pollution. It produces loss of soil organic carbon (SOC) and plant nutrients by reduces the soil output (Afshar et al., 2010).

Every year, tones of soil are lost and cause reduction of crop production as well as a pollutant to rivers, lakes and other water bodies. Soil erosion is a natural process which usually does not cause any major problem. It becomes a problem when human activity causes it to occur much faster than under normal conditions. The exposure to soil erosion is dependent on a number of factors. The most common factors are the weather conditions of the area, the soil texture, sized particles in a particular soil, organic matter content, the length and slope of the field, amount of crop rotation and direction of cultivation.

There is a need to explain, to predict and to measure soil erosion at all scales of study and truly define the influence of local soil factors as self evidence which is important for the implementation of suitable anti-erosion measures. The information of estimation of the economic and environmental on and off- site impact of losing, *in-situ*, fertile soil with its nutrients and potentially polluting constituents is also necessary (Theocharopoulos et al., 2003).

The study area for this research is in Cameron Highlands, Pahang, Malaysia. Cameron Highlands is a district in the state of Pahang, located in the north-west of the state. With the total area and is bordered by Kelantan on the north, Perak on the west

and Pahang District of Raub on the south and east (Malakahmad et al., 2008). It was about 715 km^2 in the area settled between roughly 900 m and 1800 m and was surrounded by forested peaks rising to 2032 m. There were frequent intense downpours and easily eroded soils which combined with farming on the steep slopes thus presents a challenge. The specific study area was in agricultural area. It is one of the areas with high altitude in Malaysia thus; the chance to receive fallout of ^{137}Cs radionuclide is relatively high. The ^{137}Cs contamination is positively correlated with altitude, so the upland, most susceptible sites, is mostly contaminated too (Lettner et al., 2006).

Environmental radionuclides have been successfully used to quantify soil erosion and sedimentation processes since 1970s. As demonstrated by the publication of about 4000 research papers dealing with the used of ^{137}Cs, this approach have been shown to provide a very effective means of quantifying erosion and sedimentation rates and to present a valuable compliment to conventional measurements technique (Mabit et al., 2008). However, this technique was not being applied in Malaysia especially by using the specially designed scrapper plate. The scrapper plate was also used for sand sample such as other studies. One of the sources of ^{137}Cs comes from globally dispersed by the deposition of fallout from atmospheric nuclear weapon tests in the 1950s and 1960s mostly by rainfall (Ritchie et al., 2003). ^{137}Cs is strongly and quickly absorbed on the exchange sites of the soil particles once it reached the soil surface and is effectively non exchangeable in most environments (Ritchie et al., 2003). The Chernobyl accident in 1986 also was another source of radioactive ^{137}Cs. A new source from this accident provides ^{137}Cs deposition in Europe and Western Asia (Pelt et al., 2007).

^{137}Cs activity concentration was used to calculate the soil erosion rate is in tonne per hectare per year. However, it is required the calibration procedures or conversion models (Walling et al., 2002). In the soil erosion study, any proposed models can be used to convert the measured ^{137}Cs inventories obtained from a field to estimates of the actual rate of erosion or deposition related with the sampling points (Walling et al., 2002). From the selected models, the erosion rate values are calculated that relate soil loss with cesium loss and must consequently; show a specific isotope concentration profile at that point. This inherent assumption is, there exist a specific profile of ^{137}Cs in the soil because erosion itself decreases the overall amount of the radioisotope links to its depth distribution. The application of different models to the

same experimental value of total cesium inventory results may give very dissimilar erosion rate values (Walling et al., 2002). In this research, the study areas were both cultivated and uncultivated soils and the theoretical calibration model. There are two models selected namely proportional model and mass balance models.

1.3 PROBLEM STATEMENT

Soil erosion is a major problem in agriculture. It is the deterioration of soil by the physical movement of soil particles and nutrients from a given site. This problem will continuously recur and finally affect the environment by decreasing the depth of the streams, reducing soil nutrients, affecting vegetations, more fertilizer usage and potential landslide. The ^{137}Cs will be used as a tracer in this study which offers alternative method of estimating the soil erosion. The measurement of ^{137}Cs is to derive soil erosion rates for two reasons, its long live period with regard to human scale, added to a strong advection to soil particles, and has formed a universal soil erosion tracer after precisely known the fallout episode.

1.4 SIGNIFICANCE OF STUDY

Cameron Highlands, Pahang is one of the major producers' agricultural products for Malaysia. It is important to maintain the ecological balance of this area. The topography of Cameron Highlands is hilly area, thus prone to soil erosion. A complete data set on soil erosion and deposition based on ^{137}Cs tracer technique obtained from this study could provide additional information to local authority for their future planning as to reduce the rate of erosion and possible landslide.

1.5 OBJECTIVES

The purpose of this study is to measure ^{137}Cs activity concentration in soil collected from agricultural farmland and uncultivated soil in Cameron Highlands with the specific objectives of the research are:

i. To determine the activity concentration of ^{137}Cs in soil cores samples
ii. To calculate the soil erosion rate using ^{137}Cs technique
iii. To map the ^{137}Cs inventories and soil redistribution rate