Malaysia's Stormwater Management and Drainage Master Plan (PISMA): A Public Outreach Programme Approach for a Highland Town

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Abstract: A Public Outreach Program (POP) is used to disseminate information, solicit feedback from the various and relevant parties concerned for further improvement of a certain issue(s) and address important needs for any proposed improvements. A POP was conducted in a highland town in Malaysia with the objectives of sharing and disseminating information on on-going and future infrastructural works, as well as encouraging the general public to take responsibility in controlling erosion and sediment problems and protecting the environment. 150 participants were involved in this program involving personnels from related agencies and the public. The programme included several activities which aimed at helping authorities to find solutions to the problems of erosion and sediment in the area, and raising the public awareness on protecting the environment. The programme proposed some measures to mitigate the environmental issues, and managed to raise awareness among the target groups with regards to environmental protection.

Keywords: Highland Towns, PISMA, Public Outreach Programme

Introduction

The change of land use pattern like forest to agriculture and agriculture to urbanization, and the impact of uncontrolled development have increased the flood prone areas in Malaysia. The National Strategic Stormwater Management Plan 2007 has classified 5 risk-based locations of flood prone areas, namely, island towns, coastal towns, riverside towns, upstream towns, and highland towns (DID, 2007). Flash floods occurred frequently in these areas. Among the causes are rapid and uncontrolled development in catchment areas resulting in heavy siltation, obstructions in river flow system that reduce in river flow capacity, limited available space for river improvement works to handle the ever increasing flood flow due to escalating urbanisation process, and insufficient internal drainage systems within the town area.

The development of Malaysia's Stormwater Management and Drainage Master Plan (PISMA) aims at helping solve the problem on flash floods and develop a master plan on how to effectively handle and overcome the occurrence of flash floods in this country. The outputs of this master plan are to create 1) a master plan for drainage, 2) a master plan for water quality, and 3) an infrastructure inventory system based on GIS. Based on its study on the existing conditions, PISMA has proposed

both structural and non-structural solutions to issues regarding drainage and water quality. The former includes channelization, retention pond, pump drainage and other measures, while the latter involves land use management and zoning, Public Outreach Programme, enforcement of the Erosion Sediment Control Plan (ESCP). The target groups for these approaches are developers, local governments, local and state Drainage and Irrigation Department, and members of the public.

As effective water quantity and quality management strategies involve managing good agricultural practices, as well as construction and post-construction activities, participatory approach for all stakeholders in the entire planning and management process is seen as a key factor to ensure success and sustainability of water resources management in the long term. Thus, an outreach program is seen as a meaningful and beneficial collaboration between the public and professionals. As put forward by Andrew et al. (2005), it represents the sharing of information beyond the professional world and that aspect of service directly benefits the public outreach. Along the same line, Kezar (2000) and Boyer (1996) attested that what the professionals discovered useful for the public has been viewed as important to democratic society and economy.

Although PISMA has outlined public outreach programme as one of its non-structural approaches to the water management issues, till date, reports on this approach with regards to its implementation has been scarce. Thus, this study examined the public outreach programme carried out in one of the risk-based locations identified by PISMA, that is, the highland towns. Specifically, it looked into the implementation of the public outreach programme in Cameron Highlands, a stormwater risky area of slope area, erosion and mudflow. It is hoped that the findings will benefit PISMA in evaluating its approaches in combating the water management issues.

Public Outreach Programme (POP) – An Overview

Public outreach is a concept where people from different organisations, agencies or specific audience get together to brainstorm ideas/solutions to solve any addressed issues. In this program, participants suggest useful ideas to develop planning/evaluating guides which would give an overall framework to develop public engagement (OECD, 2012). It is a way of communication, especially for municipalities, because from that they can gain stakeholders' views in the development, implementation, evaluation and modification of the integrated plan. Generally, the outreach activities focus on creating awareness, providing educational information, and motivating. From these activities, the stakeholders are able to gauge technical and other information regarding the addressed issues to provide useful input on how projects and future activities should be delivered (EPA, 2017).

According to Kazer (2000), outreach has been described as a meaningful and collectively beneficial collaboration with companions in schooling, commercial enterprise, public and social provider. The effective public participation may require changes in institutional arrangement to accomplish the participation goal. It has a similar philosophy of community-based management on natural resources which promotes stakeholder participation through power sharing and responsibility between government and local resource users.

The concept of effective outreach programme should address the important needs, and also identify and target a particular audience. The policy makers, resource managers, teachers, students, citizens, and professional and recreational groups are amongst the potential targeted audiences, depending on the purpose of the programme (Harrison et al., 2009). Since the potential targeted audiences depend on the needs, the determination of specific needs is very important in identifying the correct target. This will allow the development of the best outreach (Harrison et al., 2009). Figure 1 shows the stages of community engagement approach or the 'journey of engagement' in implementing a public outreach programme.

Nowadays, there is a nation call to realign the professional missions to fulfil their service duties to civil society (Rice, 2003; Dyer, 1999). For example, a public outreach programme had been conducted at City Burlington Vermon where stormwater activities were created to provide sustainable stormwater management. The outreach programme aimed at developing an integrated plan and collecting stakeholders' view on water quality, wastewater treatment and stormwater management. The outreach and involvement plan was implemented through tier approach that targeted different activities to different stakeholders. The stakeholder input was then used to develop a stormwater project evaluation tool (EPA, 2017).

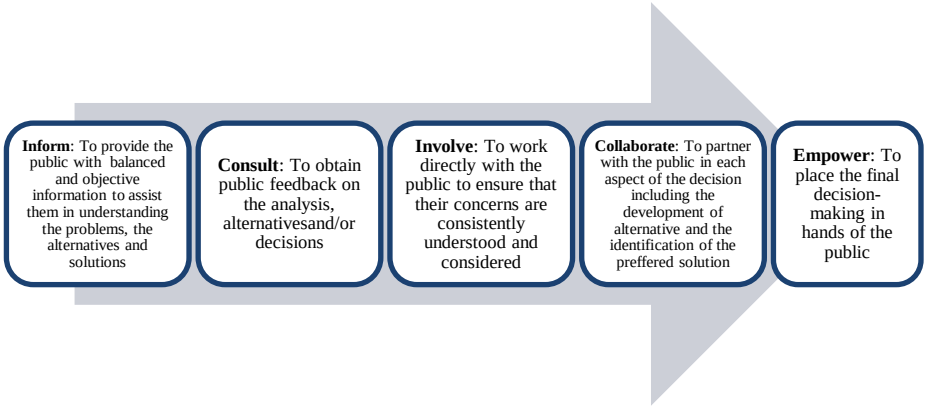

Fig. 1 Stages of community engagement approach or the 'journey of engagement' (Ramachandran et al. 2014; Storm, 2011).

Another public outreach program was carried out at Onondaga Country that received the water from stormwater and wastewater discharge. The project was initiated to improve the water quality of the lake. Current pollutant sources in the lake were sediments from mudboils, stormwater impact from urbanized area, and nutrient runoffs from agricultural operations. In order to achieve the aim of the project, interviews and meetings were held to seek input from stakeholders and representatives from the public, as well as private and tribal organisations from water resources management. The discussion focused on the restarting the potential of amendment on the phosphorus Total Maximum Discharge Load (TMDL) to allow more nutrient exchange (EPA, 2017).

In Malaysia, a public outreach program was implemented on River of Life (ROL) project where the objective of this program was to improve the attitude and behaviour of stakeholders within ROL towards river care and preservation in improving water quality and reducing pollution. The targeted participants were local community, educational institutions, hawkers, wet market operators, industry corporates and developers, and the general public. The developed public outreach model includes river monitoring program, sustainable education, river care, empowerment and ownership. The findings from this program indicate that public participation is a key towards the sustainable river basin management (Kalithasan, 2017).

Methodology

The objective of this study was to examine the implementation of PISMA's public outreach programme in Cameron Highlands and to report the outcomes of the programme. Thus, this can be expressed by the following research questions:

i. What are the approaches and strategies employed in the Public Outreach Programme in combating the issues regarding drainage and water quality in Cameron Highlands?
ii. How was the Public Outreach Programme implemented in combating the issues regarding drainage and water quality in Cameron Highlands?
iii. What are the outcomes of the Public Outreach Programme activities in Cameron Highlands?

Location of Research Area

As mentioned earlier, the research area for this study is a highland town, Cameron Highlands. It is the smallest district located at North West of Pahang (refer to Figure 2). The total area of the Cameron Highlands district is 712.18 square kilometres and it is bordered by the Lipis district (another district in Pahang) on the south-east, the state of Kelantan on the north and the state of Perak on the west. The district is divided into three *mukims*, the term used in Malaysia for subdistricts (Malaysian National Land Code 1965), comprising Ringlet, Tanah Rata, and Ulu Telom. Cameron Highlands has experienced a gradual increase in population over the years. The population growth rate is below 2% per annum as compared to about 2.3% of average national growth rate (DLO,2017).

Fig. 2 Location of Cameron Highlands District and its *Mukims*

Stormwater Management Issues in Cameron Highlands

There are several issues and problems in Cameron Highlands with regards to stormwater management, which are water quantity and water quality (inclusive of environmental aspects). In addition, these include problems that are related to natural occurrence like floods, erosions and landslides.

The occurrence of floods in Cameron Highlands has been recorded in several studies and by the Department of Irrigation and Drainage (DID). The flood events were first recorded on 23rd October 2013, followed by 4th September 2015, 25th December 2016, 3rd February 2017 and 16th May 2017 (Leh & Mokhtar, 2021). The main cause of these flood events was improper drainage system. The very heavy rainfall at the upstream part of River Ikan, River Telom and the town of Kg. Raja had caused the overflowing of the rivers through the existing urban drainage system. This had affected 36 terrace houses in Taman Matahari, the Community Clinic of Kg. Raja, a primary school in Kg. Raja, 52 business premises in the town of Kg. Raja and the light industrial area of Matahari Cerah. Similarly, the sudden overflow from the Jasar Creek had caused flash floods at the main roads and landslides/rubbles at the entrance junction of the Jasar Flat. The main cause for this was the obstruction of surface run-offs from the upstream Jasar Creek.

Cameron Highlands has become shrouded in illegal land clearings due to uncontrolled illegal deforestation for the cultivation of vegetables. The government has identified 33 critical slopes in Cameron Highlands that are prone to landslides. These critical slopes are part of the 517 sites which have been identified to be prone to landslides in the country. The mappings of the dangerous slopes have been carried out since 2014 and involve an area of 275sq km.

Data Collection & Analysis Procedures

To answer the research questions, information regarding the POP programme was gathered through interviews with the POP committee. This includes the objectives, target groups, the implementation and the expected outcomes.

In addition, the researchers also acted as participant observers during the activities involving the public. This enabled the researchers to further understand the situation in context. Interviews were also carried out with some of the participants to gauge their feelings and opinions regarding the programme.

Results and Discussion

Information regarding the approaches and strategies in implementing the programme was gauged from the interviews with the POP committee. The objectives of POP for Cameron Highlands Drainage Master Plan were to:

i. identify and determine the issues that need to be addressed in the strategy;
ii. assess the current situation about all public awareness programmes of erosion and sediment problems that had been carried out; and
iii. assess the present knowledge, attitudes and practices with regard to erosion and sediment problems.

With these objectives to achieve, two target groups were involved in this programme: 1) 50 personnel from related agencies, i.e Drainage Irrigation Department (DID), Public Works Department, *Pejabat Setiausaha Kerajaan Negeri* (State Government Secretary Office), and the local authorities department. They were selected as the agencies responsible for storm water quantity and quality, erosion and sediment issues as well as issues related to agricultural practices. 2) 100 participants including the public, which consisted of *Persatuan Pekebun Melayu* (Malay Farmers Association), horticulturists, and Non-Governmental Organisations. PISMA believes that public participation has always been recognised as a practice of stakeholder engagement. Thus, effective public participation may be able to accomplish its goal in combating the issues at hand.

Approaches and strategies employed in the Public Outreach Programme in Cameron Highlands

In implementing the public outreach programme, the committee, first, draw a framework to map out the strategies that could realise the objectives of the programme. This was very important as it would determine the methods to run the programme and the contents. Figure 3 depicts the framework of the strategies.

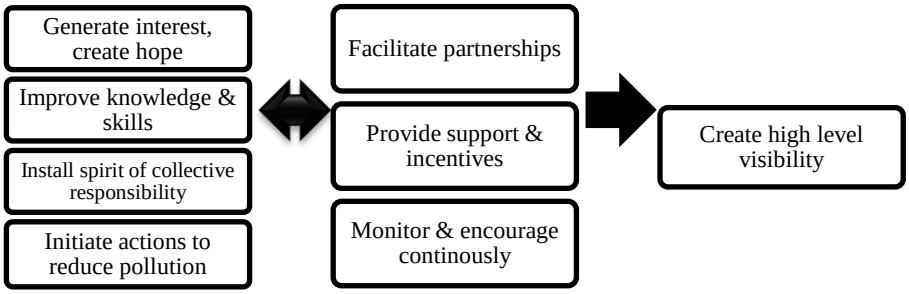

Fig. 3 Approach and Strategies for POP Cameron Highlands

Having mapped out the strategies, the committee then planned the implementation of the programme. The programme was carried out in two phases: 1) planning and development phase, and 2) implementation phase.

Planning and Development Phase

Planning and designing the outreach programme are very crucial to the success of any project. Hence, the planning phase is very important for the development of a successful POP. All the designated teams need to work very closely to plan and develop a programme framework for the POP project. The government agencies and stakeholders play very important roles to achieve the objectives of POP. The formulation of ESCP Guidelines for Agricultural Practices, feedbacks and recommendations from related stakeholders and agencies, as well as the dissemination of ESCP Guidelines for Agricultural Practices, are the crucial parts in this phase.

Table 1 shows the target group for the workshop and the POP. The POP Cameron Highlands required the involvement of all stakeholders in the project area so it would be able to meet the objectives or at least pave the way for change in awareness towards a better environment for Cameron Highlands.

Table 1. Target Groups of the Public Outreach Programme in Cameron Highlands

Group	Details
Local authorities & Stakeholders	• Government organisation that is officially responsible for all the public services and facilities in a particular area. • Individual, group or organisation impacted by the outcomes of a project. • Have an interest in the success of the project, and can be within or outside the organisation
General Public & Local Community	• General public who work or live in the area and are not in close contact with rivers in their daily life. • Typically, cynical or skeptical of government's efforts and, therefore, require credible, tangible information and reasoning. • Local communities would have ranging from the very young to the elderly.
Agricultural Entrepreneurs/ Farmers	• People who work on the land to grow and produce food, animal feed, or other consumer products; and business professionals who support agricultural production • Have little formal education, whereby their business knowledge and skills have been passed down from generation to generation.
Schools	• This generation is more environmentally conscious and very technologically savvy. • High school students are more able to execute and process complex projects, while tending to be rebellious with a preference to be out of school. • Primary school children love games and are able to take simple instructions, but would need chaperons.

As part of stakeholder engagement for these target groups, many consultations and follow-up activities were conducted with the owners and farmers. This was mainly to create awareness and to disseminate measures being undertaken by the government through this project. The engagement provided an opportunity for the programme committee to understand the day-to-day operational behaviours of the farmers and from that, to develop capacity building programmes on change behaviours and management practices for more positive impacts.

The participation rate from the target groups was initially lukewarm, but over time and through the continuous engagement undertaken by the programme committee together with authorities such as DID, many groups started to provide cooperation and showed willingness to commit and appreciate the management practices suggested. Based on prior observations, most of the farmers had not employed any guidelines given, resulting in erosion and sediment. Thus, this programme focused on promoting the use of guidelines set by the Agricultural Department to control sediments and erosion problems, to create awareness among the farmers and effect change in their operations.

Implementation Phase

The implementation of a project depends very much on the way the outreach materials and programmes are created and carried out. It also depends on the communication skills of the outreach deliverers, coordinators and community managers. The Cameron Highlands POP's committee consisted of members with social and communication skills. The programme itself was community-based and target group-based, to help provide the stewardships for river care, which at most times, was on a person to person basis, as this could be the most effective form of objective delivery. Figure 4 below shows the phases of the public outreach programme in Cameron Highlands.

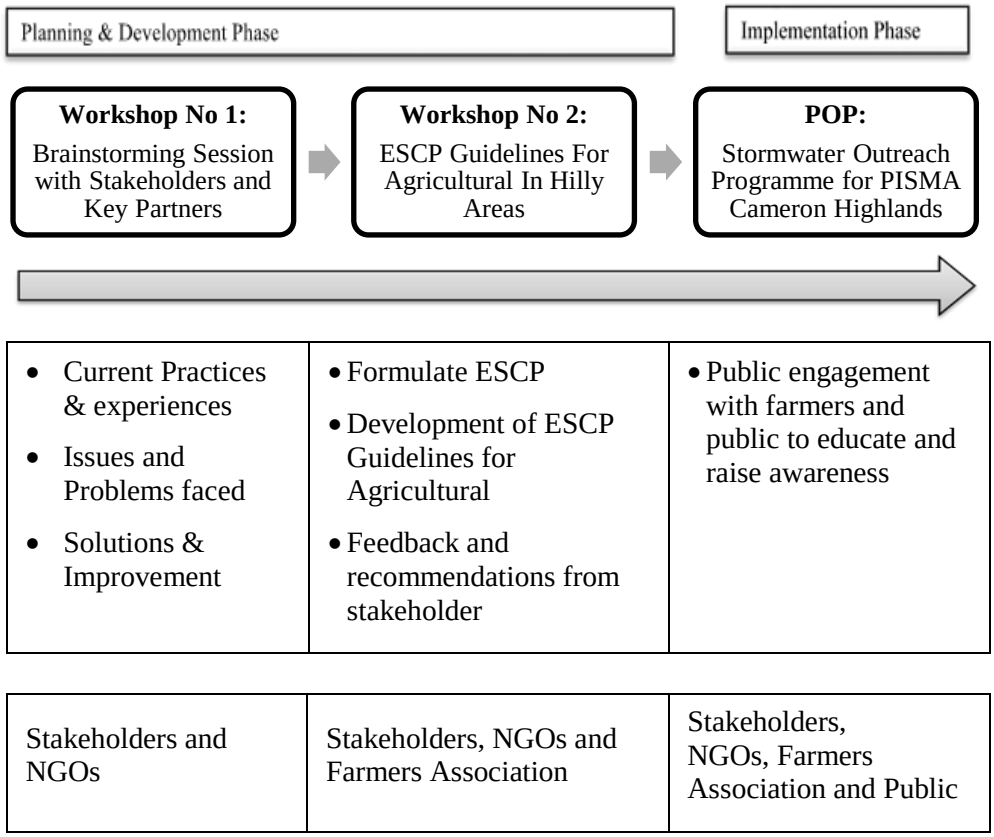

Fig. 4 The phases of the public outreach programme in Cameron Highlands.

The Implementation of the Public Outreach Programme in Cameron Highlands

The programme involved two workshops that aimed at helping authorities to find solutions to the problems of erosion and sediment in the area, and raising the public awareness on protecting the environment. In addition, a one-day programme, with activities involving the public was also carried out.

Workshop 1: Brainstorming Session with Stakeholders and Key Partners

The main purpose of the workshop was to engage and understand the aspirations of the stakeholders living in and/or have direct or indirect interaction with Cameron Highlands for this POP. The participants shared and disseminated information about Cameron Highlands and the projects to the stakeholders including the on-going and future infrastructural works and government initiatives. Besides, this session was also to understand and get feedback on local on-going activities, barriers and challenges faced.

The outcomes of the brainstorming session from Workshop 1 were issues related to stormwater quantity and quality, and issues related to erosion and sediment which were associated with agricultural practices. These included the following:

i. 70% of the rubbish are from agricultural practices
ii. Kuala Terla, Tringkap and Brinchang : rubbish dumped to the river directly from houses nearby
iii. Agricultural waste dumped in forest area
iv. River maintenance was done only in hot areas

Mitigation measures for the issues were then proposed in this workshop. These are presented in Table 2 below.

Table 2. Proposed Mitigation Measures Related to River Pollution

Item	Mitigation measures
Awareness	• Campaigns using media (TV, media social etc) to raise awareness of the public on impact of environmental pollution • Landscaping in areas that are targeted as illegal rubbish disposal • Publish articles in newspapers/electronic media regarding flooding, sedimentation and pollution issues in Cameron Highlands • Organize more frequent *gotong-royong* (communal activities that involve community and farmers
Solid waste Disposal and Agricultural waste	• Individual rubbish trap/GPT for residential areas • Appoint contractors to collect the rubbish/agricultural waste • Provide more incinerator/waste disposal area in Ringlet • Allocate more maintenance budget so that the maintenance can be done thoroughly for all river stretch in Cameron Highlands, not only focus in hot areas.
Enforcement	• Enforcement and compound by related agencies – have to be presented in Parliament • Standardize all guidelines by related agencies and to practice hard enforcements • Enforce a compound to farmers who dump wastes in forest area • River stretch divided by check dams based on Community/residential/agricultural areas (Pilot Project). If that particular river stretch is polluted, the community/farmers will have to pay compound • Standardize all guidelines by related agencies and to practice hard enforcements • Enforce agricultural waste collection tax to all farmers

The proposed solutions generated from the Workshop 1 were mainly for problems that were related to river reserves being intruded by farmers and squatters. The proposed measures included the evaluation and re-check of the *Lesen Pendudukan Sementara* (Temporary Occupation License) to be renewed once a year. In addition, the farmers need to comply with requirements on building proper storage for fertilizers, fertilizers management and periodic inspection by the Agricultural Department after approval. As for local authorities such as DID, they need to report to the *Pejabat Tanah* (Land Office) if there is any structure with unknown status built on river reserves.

The brainstorming session also reported that pesticides and fertilizers waste were thrown directly into the rivers. There were collection centers for pesticides and fertilizers waste, but they had

not been used properly. Besides, there was no specific system for pesticide boxes disposal. Table 3 shows the proposed mitigation measures for problems related to pesticides and fertilizers waste.

Table 3. Proposed Mitigation Measures for Problems Related to Pesticides and Fertilizers Waste

Item	**Mitigation measures**
Rules and Regulations	• Rules and regulations related to pesticides and fertilizers – to be recycled and re-used • Enforcement and introduce license for pesticides sale • Influence farmers leaders to inform farmers on any latest information or regulations
Authorities Approach	• Frequent System 2L – "Lawatan & Latihan" (Visit and Training) to raise awareness among farmers to practice correct agricultural methods • Leaders for each farming area to control the agricultural practices • Delivery of information using multilanguage • To organize more programs involving farmers – example: GEOMURNI
Systematic Disposal	• Disposal of pesticide containers: The usage of Plastic Biodegradable 4r, Incentive – Farmers to collect the pesticide containers and pesticides companies to buy back the empty containers (recycle) • DOA has introduced 'Program Sistem Bilas 3 Kali' (Rinse 3 Times System Program) before pesticide containers are disposed. • Findings from research: pesticide containers will be 99% free from chemicals if it is washed 3 times • Seminar regarding pesticides to be conducted once a year by (Department of Environment)

Workshop 2: Erosion & Sediment Control (ESCP) Guidelines for Agricultural Practices in Hilly Areas

A one-day workshop involving all relevant agencies, farmers' association and the project team was held on 15th May 2018 at Hotel De La Ferns, Cameron Highlands. The main objectives of this workshop were to get feedbacks and recommendations from stakeholders on ESCP Guidelines for Agricultural Practices in Hilly Areas. This guideline is very important for farmers as a practical knowledge and skill sets are needed to deal with issues/challenges as well as applicable regulatory requirements related to erosion and sediment control (ESC). The objectives of this workshop were to:

1. present the content and details of the ESCP Guidelines for Agricultural Practices in Hilly Areas;
2. assess the level of present knowledge and practices with regard to erosion and sediment issues in Cameron Highlands;
3. gather feedbacks, comments and suggestions from authorities, shareholders and farmers regarding the guidelines; and
4. produce comprehensive ESCP Guidelines for Agricultural Practices in Hilly Areas based on the feedbacks from the Workshop.

All comments, feedbacks and proposal for improvement of the ESCP Guidelines for Agricultural Practices in Hilly Areas were also collected during the workshop.

Workshop 2 has produced comprehensive guidelines which contain the elements of explanation on proper water management such as the need to improvise the drainage system, proposal of water catchment area, application of rainwater harvesting system and providing proper farm waste management. Besides, it also covers the design guidelines for Erosion Sediment Control Best Management Practices (ESC BMPs) for agricultural farms, suggesting that the proper ground water management must be provided to control erosion and the purpose of stormwater management must be stated clearly, and proper irrigation practice and crop cover and mulching types need to be stated in guidelines.

Public Outreach Programme Activities in Cameron Highlands

A one-day POP involving all the relevant agencies, farmers' association, the project team and community was held on 30th July 2018 at Dewan Balora, Taman Sedia, Cameron Highlands. The main objective of this workshop was to educate and raise awareness among the public on the importance of protecting the environment. This programme is very important to guide the public in developing future education and outreach program evaluation studies**.** Specifically, the programme aimed at informing and involving the general public and encouraged them to take responsibility in controlling erosion and sediment problems and protecting the environment.

There were a few key activities of the POP as shown in Table 4. For example, during the programme, all stakeholders and local authorities in charge played their roles to accommodate the participants and establish relationship with the community involved.

Table 4. Activities during the Cameron Highland's Public Outreach Programme

Parties	**Activities**
Schools	• Educational posters, video and brochure • Colouring contest for primary school • Water Quality Test Kit and Quiz for secondary school
Communities	• Educational posters and video • Quiz • Photography competition • Media (FB, feedback form)
Farmers	• Informational posters, video and brochure • Simplified guidelines • Find your farm to identify your risk level • Agricultural Best Management Practices in Hilly Area
Educational Research	• Product demonstration • Educational and awareness posters

As participant-observers in the programme, the researchers could see that the public were concerned about the environmental issues around their area. This was shown in their enthusiasm and active participation in getting information and knowledge from the stakeholders and authorities in taking more care of the environment. Interviews were also carried out with some of the participants to gauge their feelings and opinions regarding the programme that has been conducted in order to reduce the erosion problem and stormwater management in Cameron Highland. One group of participants came with the opinion related to how to convey this message to politicians and certain municipalities were lacking in erosion control and stormwater management experience. Meanwhile other respondents emphasised there was a need to strengthen the law or standard procedures in order to reduce the effect of erosion and efficiently manage the stormwater management.

POP in Cameron Highlands: The Way Forward

To ensure the success of this program in a long term, different approaches and delivery methods should be employed. It is important to understand that different people have different styles of learning. Therefore, in designing and implementing the future POP in Cameron Highlands the organising committee should consider a variety of approaches such as holding campaigns and talks, training and workshops, as well as activities and initiatives.

Campaigns and talks can be useful in community engagement. Any type of campaign and talk can be used to educate and raise awareness to public. The information should contain knowledge and facts to provide the opportunity for the public to support the programme. In addition, by holding workshops or training sessions, participants can increase knowledge and awareness of the use of conservation practices. For example, invite those who are likely to use the workshop training, or invite specialists on the topic or provide training on new skills to stakeholders to improve their capability and knowledge. The workshop or training sessions should start by identifying the problems of the specific area. This should be followed by recommending solutions that can be used on various land types. Other than that, the programme should associate and collaborate with any ongoing state/local government activities, private sectors and local community in overcoming river and sediment issues in Cameron Highlands. The activities or initiatives should encourage the participation from the public and focus on practical actions rather than theoretical information dissemination approaches. By providing opportunities for the public, they can improve or practice their skills and knowledge obtained from the activities to help in the long term plan.

Another effective approach is by involving the media. It is one of the methods to disseminate information faster. In addition, media is useful for informing a large audience or reinforcing messages with simple concepts and has become a part of everyday life for many people. It is an easy way to access information on a whole range of topics. In the right scenarios, media approach can provide a wealth of information to people and motivate them to act.

Conclusion

The outreach evaluations are relevant when the outcomes are likely to be used by the community-based organisations and practitioners. The contributions from all parties in judgments of success make the valuing process transparent and provide a wider view of stakeholder values. Furthermore, the involvement of the community-based organizations and practitioners is to ensure the incorporation of original knowledge and experience in identifying local needs and setting priorities establishing the values by which outreach success will be judged. The implementation of POP can help both parties (professionals and community) to understand the day-to-day operations in Cameron Highlands, thus, contribute towards the effective strategies on the management practices for more positive impacts.

Co-Author Contribution

This article's writers declare no conflict of interest. Author 1 and Author 4 conducted the fieldwork and and research technique. Authors 2 are responsible for the literature, interpretation dan discussion of findings. The research findings were discussed by authors 2 and 4. Author 3 proofread and revised the study while also contributing insights into it.

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