

The Environmental Impacts of Unauthorized Activities. A Case of the Maragala Mountain Range Environment protection area in Sri Lanka

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Abstract

Unauthorized activities are generally known as illegal activities. Unauthorized activities mostly take place in mountainous ranges. This system originally belonged to the ago-farming system and falls within the larger scope of sustainable agriculture. In recent decades, however, considerable literature has shown that chena cultivation and the people who use it neglect their environmental responsibilities. Therefore, the purpose of this study is to systematically review and identify the environmental impact of unauthorized activities in the mountain range. The study was conducted in the Maragala mountain range EPA using 120 families focusing on 2 Gramaniladari divisions. Descriptive statistics were used for quantitative data analysis and content analysis was used for qualitative data analysis. With Results revealed that currently, people cut down 76% of trees on the premises ignoring the principles of chena cultivation and trade. Mechanical saws have been used for this purpose. 62% of the land is encroached land and also, and they doing agricultural activities without permission. More than 80% of the sample families have removed all trees in their fields during the last five years. Forest fires rapidly increased last five years as a result of chena cultivation that destroyed 500 acres of forest area. The main reason for all these activities is the settlements located in the upper part of the Maragala mountain range EPA. The study revealed that the patterns of agricultural land use in traditional villages have changed significantly over the past few decades.

Keywords: Environment protection area, Encroachment, Forest fire, Illegal logging, Minimize

INTRODUCTION

Mountain range is one of the high-ecological environmental areas. It has a rich biodiversity. The mountain range is preserved as a forest and starting point of the many rivers. According to the UN Environment Program, 24% of the earth's land mass is mountainous and its environment includes elevation of at least 980ft - 8200ft (United Nations Environment Programme, 2020). At present, these mountain ranges are threatened with extinction. Therefore, mainly affects unauthorized activities. unauthorized activities are known as illegal, unlawful, unjustified, and environmental crimes. Unauthorized activity is any activity that breaks the equilibrium of the environment or destroys the environment (European Union Agency for Law Enforcement, 2015). Environmental crimes encompass a broad list of illegal, unregulated, and unreported fishing and illegal logging and trade in timber. On one side, environmental crimes are increasingly affecting the quality of air, water, and soil, threatening the survival of species and causing uncontrollable disasters (Environmental crimes, 2019).

The Maragala Mountain Range supports a unique combination of intermediate zone forests. It was declared an Environmental Protection Area (EPA) on 1st August 2008, by the Central Environmental Authority (DevakaWeerakoon, 2014). Scientific studies on the Maragala Mountain Range and its biodiversity are scarce. Observations that have been made in the past indicate that the area supports a rich assemblage of floral and faunal species akin to that of a wet zone forest. The Maragala Mountain has a high-quality water catchment area. It is the main water resource in the Monaragala town area, and it has a rich ecosystem (Alston, 1929).

According to the above matter, the Maragala mountain range is a sensitive area and also a very important area for Monaragala's people because this mountain range is the one and only catchment area that is the water supply for these people. But nowadays this mountain range affects many Environment impacts. This research will expect to identify the environmental impact of the Maragala mountain area due to the unauthorized activities, factor for

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unauthorized activities, give solutions, and arise management plan.

Maragala mountain range is an environmentally sensitive and important area. But unfortunately, the Maragala mountain range is at risk due to unauthorized activities. Such as unauthorized logging, forest fire, unauthorized agricultural activities, unauthorized lands, and encroachment, disposal of adversely solid waste, disposal of adverse wastewater to water sources, propagation of invasive plants and animals, and also affecting many environmental impacts (DevakaWeerakoon, 2014). This research expects to identify the environmental impacts of the Maragala mountain area due to the unauthorized activities, identify dominant unauthorized activities in the Maragala mountain range, and preparation of plans to minimize the environmental impacts of unauthorized activities in the Maragala mountain range.

REVIEW OF LITERATURE

The environment is a very important part of the world. According to (Hemlata Pant, 2020) "The word environment refers to all ecological units which are naturally present on earth in the form of land, water, air, soil, forest, sunlight, minerals, living organisms, etc. This earth is full of natural surroundings, some are biotic, and some are non-biotic. Currently, the situation of the environment is very poor that could never be imagined by our ancestors in previous." because of that humans are doing many harmful activities to environment that create environmental impacts. Sustainable Mass Transit mention about Environmental impacts are changes in the natural or built environment, resulting directly from an activity, that can have adverse effects on the air, land, water, fish, and wildlife or the inhabitants of the ecosystem. Pollution, contamination, or destruction that occurs because of an action, that can have short-term or long-term ramifications is considered an environmental impact (Abdallah, 2017). And also (Ryan, 2016) Hazard Mitigation in Emergency Management mention given idea about environmental impacts such as An environmental impact statement (EIS) is a critical examination of any potential impacts from the proposed project and proposed alternatives. The EIS process starts with a Notice of Intent to Prepare an EIS and concludes with a Record of Decision (ROD), a document that explains the reasons for selecting a certain action. The EIS is available to the public for information and comment.

United Nation Integrational Crime & justice research Institute mention about Environmental crimes encompass a broad list of illicit activities, including illegal trade in wildlife; smuggling of ozone-depleting substances (ODS); illicit trade of hazardous waste; illegal, unregulated, and unreported fishing; and illegal logging and trade in timber. On one side, environmental crimes are increasingly affecting the quality of air, water and soil, threatening the survival of species and causing uncontrollable disasters. Despite these issues, environmental crimes often fail to prompt the appropriate governmental response. Often perceived as 'victimless' and incidental crimes, environmental crimes frequently rank low on the law enforcement priority list, and are commonly punished with administrative sanctions, themselves often unclear and low (Environmental crimes, 2019).

Environmental Impact Assessment (EIA) as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning

and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision-makers. By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoided treatment/clean-up costs, and impacts of laws and regulations (Convention on biological diversity, 2010).

Mountain ranges are currently under threat. Therefore, affected unauthorized activities, in a cause impact on society, economics, culture, and the environment. And also highly affected by the environment. The Maragala Mountain Range was declared as an Environmental Protection Area (EPA) on 1 August 2008, under the provisions of Sections 24C and 24D of the National Environmental Act No. 47 of 1980 as amended, with the Central Environmental Authority (CEA) having the jurisdiction to manage and exercise power over this area. The area is an isolated mountain range scientific studies on the Maragala Mountain Range and its biodiversity are scarce. However, observations that have been made in the past indicate that the area supports a rich assemblage of floral species akin to that of a wet zone forest, as well as many faunal species, including several endemic fish, amphibian, reptile, bird and mammal species. The mean annual temperature of the Maragala area differs with changing altitude. The mean annual temperature of the lower part of the Maragala Mountain Range EPA ranges between 25° C and 27.5° C, while the mean annual temperature at higher elevations ranges between 20° C and 22.5° C. Given these conditions, the high-altitude area of the Maragala Mountain Range is considered by some as belonging to the mid-country wet zone (Panabokke, 1996).

Devaka Weerakoon (2014) and his team in collaboration with the Central Environment Authority (CEA) have carried out this study. It "They examined biodiversity of the Maragala Mountain Range EPA, factors for damage the Maragala mountain area and provide recommendations for the conservation and management of the site. Primary and secondary data were used for this study. The study consists of several components. Belt transects of the dimensions 5 x 50 m were used to sample the flora and fauna of the site for Rapid biodiversity assessment. Details of the physical characteristics and threat data were obtained, where possible, from available data, as well as through field observations and analyses of satellite images and available land use maps. GIS analysing method and statistical analysing method. Data interpreted by map, table Graph, and Image. The final result and conclusion was illegal logging and Chena cultivation affected to damage environment there for developed the management plan for Maragala Mountain Range Environmental Protection Area (DevakaWeerakoon, 2014).

Nordic central for spatial development organization implemented study about "Mountain Areas in Europe": Analysis of mountain areas in EU member states, acceding and other European countries in 2004. This organization studied about analysed the measures and policies implemented by national governments and the EU with regard to mountain areas; to evaluate the impacts of these measures and policies; and to develop proposals for adjustments to make them better suited to the situation of mountain areas, their needs, and opportunities. They used primary and secondary data collection methods. Quantitative data compiled by the national experts from national sources in the respective country, wherever possible collected at NUTS 5 national reports compiled by

the national experts based on interviews and review of documents, complemented by responses from European organizations concerned with mountain issues; data recorded within geographic information systems (GIS). Finally they were recognizing the great diversity that characterizes these areas (gleersen, 2004).

PRA is a systematic, semi-structured activity conducted on-site, by a multidisciplinary team. It is basically a bottom-to-up approach to learning rural life forms with and by rural people. Due to the active participation of community members as well as scientists, PRA has become a useful method to focus attention on people, their livelihood, and their relationship with social and economic factors. It is a good technique to help the community members make an appraisal of their livelihoods and issues related to them. Diverse information is collected during PRA using a number of techniques (A Roy*, 2017)

PRA is “a family of approaches and methods to enable rural people to share, enhance, and analyze their knowledge of life and conditions, to plan and to act” (Chambers,1994). It has been called “an approach and methods for learning about rural life and conditions from, with, and by rural people.” The PRA approach is a set of participatory and largely visual techniques for assessing group and community resources identifying and prioritizing problems and appraising strategies for solving problems. It takes into account the knowledge and opinions of rural people in the planning and management of development projects and programs and transfers the role of planning and decision-making, traditionally taken by stakeholders and development agencies, to the target group or community itself. PRA is to encourage local communities to carry out their own analysis, come to their own conclusions and design their own development programs and it is important to reduce the problems of mismatch between what is being provided by the stakeholder and what is needed by the community. (Waniganeththi, n.d.)

Qualitative Data Collection using PRA. The PRA tool which was used in the community was Problem tree Analysis. Problem tree analysis helps stakeholders to establish a realistic overview and awareness of the problem by identifying the fundamental causes and their most important effects. The main output of the exercise is a tree-shaped diagram in which the trunk represents the focal problem, the roots represent its causes, and the branches its effects. Such a problem tree diagram creates a logical hierarchy of causes and effects and visualizes the links between them. It creates a summary picture of the existing negative situation. Qualitative Research - PRA Tool Application and Observations in the Field Two research teams conducted Problem tree analysis in the community. The team was able to use the tool and found four major problems in the villages. The problem tree helped the team as well as the community members to know the core cause of the problems. In the following depictions of the outcome of the application of the tool and eliciting of data, each focal problem with the primary cause and undesired effects have been highlighted. Also, an objective tree for each problem with the desired change, proper means, and ends has been highlighted as a way forward. (Casimirraj, 2020)

The chi-square test is a nonparametric test used for two specific purposes To test the hypothesis of no association between two or more groups, populations, or criteria and to test how likely the observed distribution of data fits with the

distribution that is expected. It is used to analyze categorical data. It is not meant to analyze parametric or continuous data. It may be clearly understood that the Chi-square test only tells us the probability of independence of a distribution of data or in simple terms it will only test whether two variables are associated with each other or not. It will not tell us how closely they are associated (Rakesh Rana, 2020).

METHODOLOGY

Maragala Mountain Range is located in the Monaragala district. Maragala mountain range is about 2500ft in height and about 10km in length. The coordinates are 60 52`18.00 N-810 23`04.00E at the top of the Maragala Mountain Range. Usually, Monaragala has dry climatic conditions, but this area has cold climatic conditions. Annual rainfall is 25000mm and temperature is 200c 250c. (foreca, 2020) This area is a high biodiversity area. It has an endemic flora and fauna species. In the past time, this area had tea estates as a result of many Tamil people living in this area. Monaragala GND and Aliya Watta GND use for this research as the sample study area.

Primary data used to conduct this research. Questionnaire surveys, PRA surveys, discussion, and field observation were used as primary data collection methods. In this study, two types of sampling techniques were used. These were purposive and random sampling methods. The purposive sampling method was used for the selection of study areas which are Aliyawatta and Monaragala GNs and the discussion group. The random sampling method was used for the questionnaire survey and mentioned of selection 120 families. The discussion was conducted with government officers. Formal observations were done and covered the activities of sand mining, chena cultivation, illegal logging, solid waste disposal, polluted waterways, invasive flora and fauna, and unauthorized settlements. PRA survey was carried out with a discussion group and residents of GNs. Secondary data were used as reports, articles, books (Literature review), digital data, 1:50000 maps, satellite images (2009, 2015, and 2018), and images for identifying some unauthorized activities.

The quantitative data were analyzed by using the chi-square test available in the IMB SPSS-20. (Formula as $\chi^2 = \sum (O - E)^2 / E$). The qualitative data are analyzed using the descriptive analysis method and also qualitative data were analyzed using problem tree analysis (problem tree, objective tree, solution tree) in the PRA tool method. The GIS technology was used to mapping for land use maps, Drainage maps, and zoning maps, these maps were used to minimize the problem. Maps, charts, tables, and Google images were used for data presentation.

RESULTS AND DISCUSSION

Identify dominant unauthorized activities in the Maragala mountain range EPA.

Information was obtained through observation, questionnaires, and discussions. Maragala mountain range EPA is being analyzed for unauthorized activity in relation to the permitted activities in the gazette notification of the Maragala mountain protection zone published on 1st August 2008 data analysis is done in detail using GIS technology, satellite image, and MS Excel -2013 (See table 1).

Table 1: Permitted Activities

No	Permitted uses up to the 1000ft contour line
1	Construction and infrastructure development of whatever nature
2	Agricultural activities
3	Tourism and recreational activities
4	Parks, playground
5	Education and research activities
6	Reforestation and plant nurseries
7	Drinking water projects
8	Housing construction
Permitted uses From 1000ft contour line to the summit of the Maragala Range	
1	Reforestation and perennial crop
2	Education, religious and research activities
3	Camping sites, nature trails
4	Develop and maintain existing residential buildings
5	Water supply projects
6	Development of infrastructure related to permitted activities

Sources: Gazette notification of the Maragala mountain protection zone 1st August 2008.

Unauthorized activities were identified in accordance with the above activities. Accordingly, the main unauthorized activities taking place in this area were identified through observations in the area and discussions with the institution officials.

- Illegal logging
- Unauthorized lands and encroachment
- Forest fire
- Unauthorized agricultural activities
- Disposal of adversely solid waste



Figure 1- Unauthorized logging 1

- Disposal of waste to water sources
- Propagation of invasive plants and animals

Illegal logging

Unauthorized logging is one of the most common types of unauthorized activities. It has been reported 76% of illegal logging takes place in this area (chamindha, 2020). This condition is more common in the upper lands. Plantation settlements are located in the upper lands and they are prone to unauthorized logging for firewood/timber 69% due to their low economic status (See figure 1 & 2).



Figure 2: Unauthorized logging 2

Sources :field observation

Forest fire

According to the assistant director of the disaster management unit Ravindra Kumara, the forest fires have been by chena cultivation, obtaining leaves for beedi

production, hunting for animals, clearing reserves for unauthorized lands, and encroachment cultivation and grabbing. According to the disaster management unit, the largest number of forest fires occurred in 2016-2019 and many small forest fires have been reported lots a year. More details are given in table 2.

Table 2: Reported Forest fire in Maragala mountain range EPA

Year	Area
2016.06.28	Maragala mountain range EPA
2016.10.11	Aliyawatta watershed zone
2018.08.20	Aliyawatta watershed zone
2019.03.22	Maragala mountain range EPA
2019.07.06,07,08	Slope around Maragala town in Maragala EPA (huge damage)
2019.08.30	Maragala mountain range EPA

Sources: Disaster management forest fire report in Monaragala 2020

A forest fire destroyed over 500 acres of forest area in 2019/07/06-2019/07/08. In this context, most of the forest fires have taken place on the slopes of the Monaragala city area and in the catchment areas of Aliyawatta. According to the statement by the Grama Niladari of Aliyawatta, these activities are mostly due to the unauthorized activities of the Tamil people living in the upper part of the area.

Unauthorized agricultural activities

According to the Maragala mountain range Environmental protection gazette, agriculture is permitted in the area up to 304m. However, afforestation and perennial crops are allowed on contour lines longer than 304m. The chena

cultivation in this area is spread over an area of 144697acre and the seasonal crop is spread over an area of 136204 acres to the upper part of the area.it is very clear from the maps also, there is a risk of forest fire in the nearby grasslands due to land clear for chena cultivation in the south part of the area. It is clear from the field observation that the paddy fields constructed in this zone during the period 2018-2020 are in the "Akkara 8 village". This is also found in the field of more than 1000ft. The paddy field is spread over an area of 1 ½ acres. Also, according to this gazette notification, a home garden has not been permitted (see maps 3 & 4 for more information).

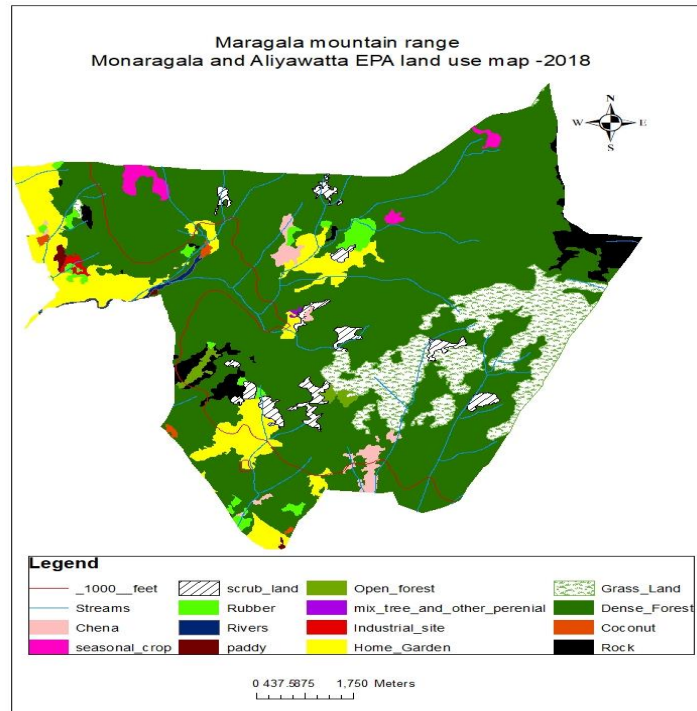
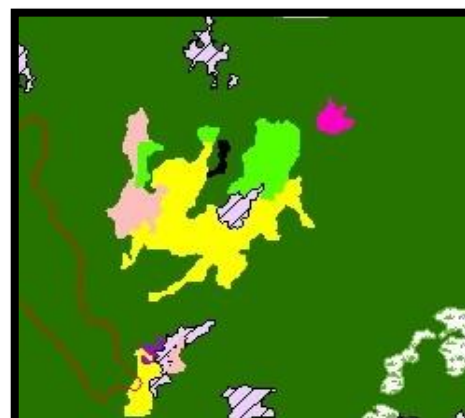
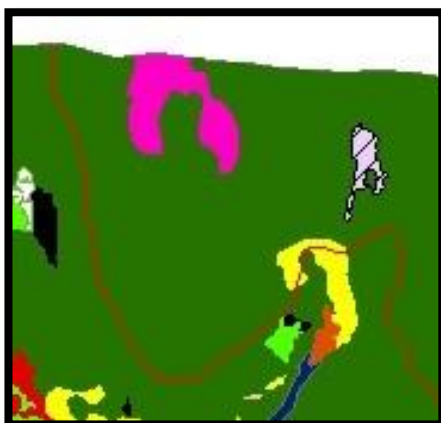


Figure 3: land use map in Maragala mountain range EPA
Sources: land use department report, 2018



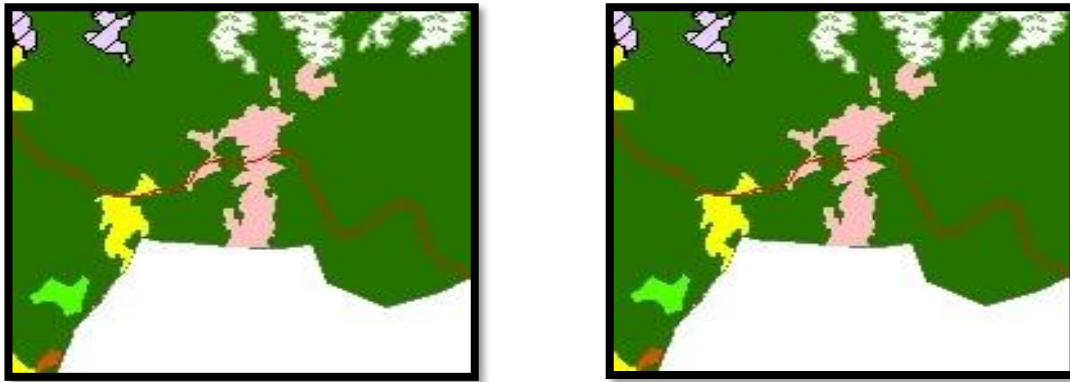


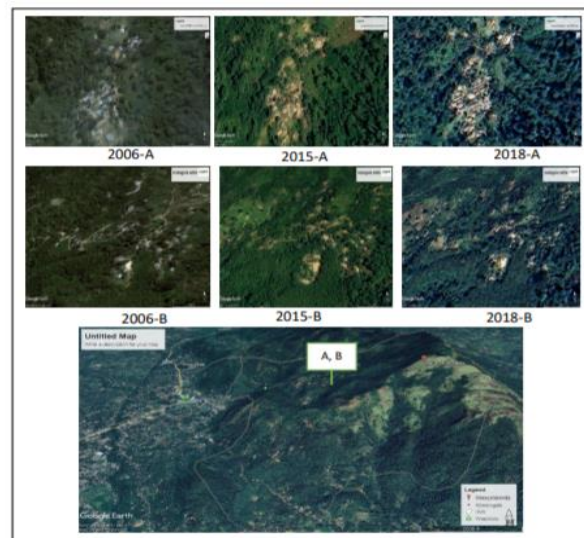
Figure 4: unauthorized agriculture activities plot in Maragala Mountain rang EPA

Source: land use department report, 2018

Unauthorized lands and encroachment

According to the gazette notification issued in connection with these ecosystems, there is a possibility of any kind of construction and infrastructure improvement in the area less than 1000ft. However, it is possible to upgrade existing residences in areas with more than 1000ft of contour line but it is not permission to rebuild. The following satellite

image shows the distribution of existing buildings in the area between 2006,2015,2018 indicating that the area has increased the number of buildings and expanded that area (Figure 5). The area belongs has been inhabited by plantation workers since early 1956. It is currently growing rapidly and it is clear that constructions carried out after 2008 fall under the category of unauthorized constructions.



Figures 5: satellite image in unauthorized settlement area and land

Sources: Google earth pro, 2019.

According to Sampath Pethikada Report (2021), there are 57 homeless people in Monaragala and Aliyawatta areas. It can be concluded that they have settled in this area illegally. According to the Sampath Pethikada, this area has unauthorized land freehold lands, and plantations can be found. Unauthorized lands are spread over an area of 123 acres out of which 122 acres belong to the Aliyawatta division. According to the statement made by Aliyawatta Grama Niladari. "Although these lands have been released by the land reform commission (LRC), they have not been given legal ownership "Accordingly, 183 acres belonging to LRC land also belong to the unauthorized lands and it can be concluded that the number of landless families is about three hundred and they also belong to the unauthorized land. According to the Questionnaire survey, 62% of residents included their land as encroachments.

Propagation of invasive plants and animals

97% of residents who represent their area have invasive plants and animals. Its widespread is due to plantation and agriculture activities, home gardens may also have contributed to this area. Due to the agricultural activities carried out in this area, plants such as Thunessa, Thunhiriya, and Agamula Nethi Wela have spread. Also, the crop that has been used by the conservation movement for plantation cultivation is widely seen as a project that the ornamental plants prepared due to home gardens. The Lantana camara plant is widespread in the open low land and the nylon Bovitiya, Podisinnomaran, wild Gansooriya is found near waste sources.

The area was also infested with aphids and fruit flies due to agricultural activities according to CEA report Kaluthara Bella, land snails, Thalapiys, Guppya were found. It is created that there is an unauthorized or spread of invasive plants and animals in this area.

Maragala mountain range EPA has been analyzed for unauthorized activities related to the permitted activities in

the gazette notification of the Maragala mountain protection zone. Accordingly, the main unauthorized activities taking place in this area were identified through observations in the area and discussions with the institution’s government officers.

- Unauthorized logging
- Forest fire
- Unauthorized agricultural activities
- Unauthorized lands and encroachment
- Disposal of adversely solid waste
- Disposal of adverse wastewater to water sources
- Propagation of invasive plants and animals

This condition is most common in the upper part of the mountain range. Plantation settlements are located in the upper lands and they are prone to unauthorized activities because the inhabitant’s economic status is low.

Analysis of the environmental impacts of Maragala mountain range EPA due to unauthorized activities.

Quantitative data analysis method used for the analysis of the environmental impacts of Maragala mountain range EPA due to unauthorized activities. Quantitative data analysis is

Table 3: Decrease water quality in its water sources

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	79.723 ^a	32	0.000
Likelihood Ratio	55.363	32	0.006
Linear-by-Linear Association	.155	1	0.694
N of Valid Cases	119		

Sources: Questionnaire survey, 2020.

The value of P is less than 0.05. There is sufficient evidence to reject H₀. It has been confirmed that there is a link between declining water quality and unauthorized activities in the Maragala mountain range. The water quality of the area has deteriorated due to solid waste disposal, discharges from household and industrial wastewater into water sources, and Effluent from toilet waste with water.

Table 4: Invasive plant and animal proliferation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.232 ^a	32	.026
Likelihood Ratio	60.190	32	.002
Linear-by-Linear Association	5.736	1	.017
N of Valid Cases	119		

Sources: Questionnaire survey, 2020.

The value of P is less than 0.05. There is sufficient evidence to reject H₀. It has been confirmed that there is a link between the spread of invasive plants, animals and unauthorized activities in the Maragala mountain range EPA. Unauthorized agricultural activities and irregular plantations in Maragala EPA are the reasons for the spread of invasive

Table 5: Soil erosion

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	98.502 ^a	64	.004
Likelihood Ratio	54.620	64	.792
Linear-by-Linear Association	2.987	1	.084
N of Valid Cases	118		

Sources: Questionnaire survey, 2020.

The value of P is less than 0.05. There is sufficient evidence to reject H₀. It has been confirmed that there is a link

the presentation of an accepted statistical data analysis method in that the information obtained from the survey can be systematically determined. The chi-square test was used for this study. The information obtained from the questionnaire. Below major content depends for identify the environmental impact of Maragala mountain range. Such as;

- Decreased water level in water sources
- Decreased water quality in water sources
- Invasive plant and animal proliferation
- Endangered endemic plant and animal
- soil erosion
- landslide and soil fragmentation
- soil infertility

Table 3 shows the chi-square test on whether is a link between unauthorized activities in the EPA of Maragala mountain range and decreased water quality in water sources.

Residents of Monaragala City suffered hepatitis in 2015. It was reported that this water had mixed with feces. They are consumed by streams flowing from the top of the Maragala mountain ranges. Table 4 shows the chi-square test on whether is a link between unauthorized activities in the EPA of Maragala mountain range and invasive plant and animal proliferation.

plants and animals. Ornamental plants associated with home gardens were also seen spreading beyond the house. Accordingly, the spread of invasive plants and animals than the endemic species. Chi-square test on whether is a link between unauthorized activities in the EPA of Maragala mountain range and soil erosion.

between the soil erosion due to unauthorized activities in the Maragala mountain range EPA. It can be concluded that

the Maragala mountain range EPA is being affected by the environment due to unauthorized activities. In the Maragala mountain range EPA unauthorized logging, unauthorized agriculture activity, animal husbandry, and forest fire are causing soil erosion.

All values of the Pearson chi-square (P) are less than 0.05 (Table 4). There is sufficient evidence to reject H_0 . It has been confirmed, there is a link between unauthorized activities and environmental impacts in the Maragala mountain range EPA. It can also be concluded that the Maragala mountain range EPA has been an environmental impact due to unauthorized activities.

Table 6: Environment impacts in Maragala mountain range EPA

Independence hypothesis	Pearson Chi-Square (P)
Decrease water level in its water sources	0.000
Decrease water quality in its water sources	0.000
Invasive plant and animal proliferation	0.026
Endangered endemic plant and animal	0.000
Soil erosion	0.004
Landslide and soil fragmentation.	0.048

Sources: Questioner survey, 2020.

Design of plan to minimize the impact on the environment due to unauthorized activities in the Maragala mountain range EPA.

The PRA tool was used to analyze the information obtained during the preparation of the activity plan to minimize the impact on the environment caused by unauthorized activities in the Maragala mountain range EPA. The activity plan was created using the problem tree, objective tree, solution tree

The problem tree is created according to the ideas and suggestions of the residents. The main problem is the environmental destabilization which has several consequences. That is, the destruction of water sources, the destruction of the ecosystem, the destruction of the soil due to the destruction of water sources, the water level in the Water sources has decreased and the quality of the water has decreased. The causes of this environmental instability

can be divided into seven categories. These include unauthorized land and encroachment, unauthorized logging, unauthorized sand mining, forest fire, unauthorized agricultural activities, disposal of waste and polluted water to water resources, and the spread of invasive plants and animals. Problem tree analysis (Figure 5.12: Problem tree) clearly explains the cause and effects of environmental instability which is a major problem. The objective tree (Figure 5.16: objective tree) has been created using the problem-solving objectives of the problem tree prepared according to the research. The main objective is to eliminate environmental stability. Thus, the causes of environmental instability must be eliminated. PRA test the third step is creating a solution tree (Figure 7). the tree that is designed to solve the main problem to achieve the main goal is called the solution tree. Accordingly, the impact on the environment due to unauthorized activities in the Maragala mountain range EPA is environment destabilization

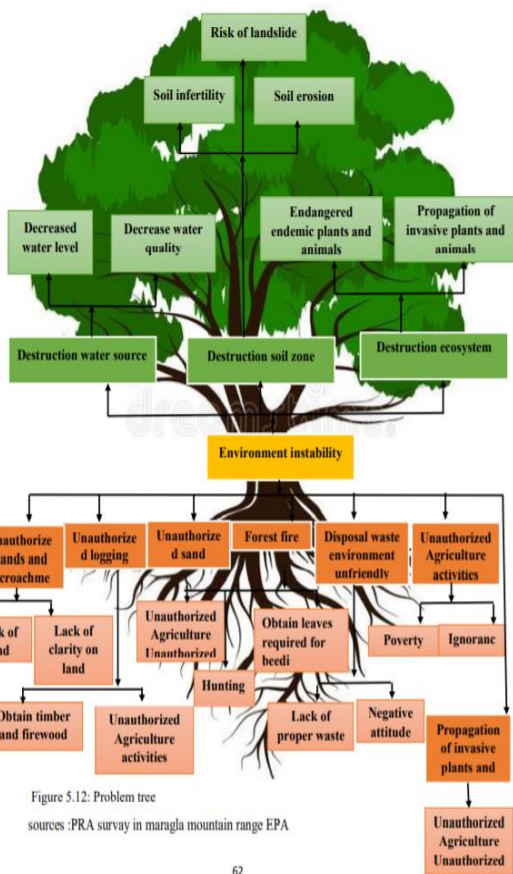


Figure 5.12: Problem tree sources :PRA survey in maragla mountain range EPA

62

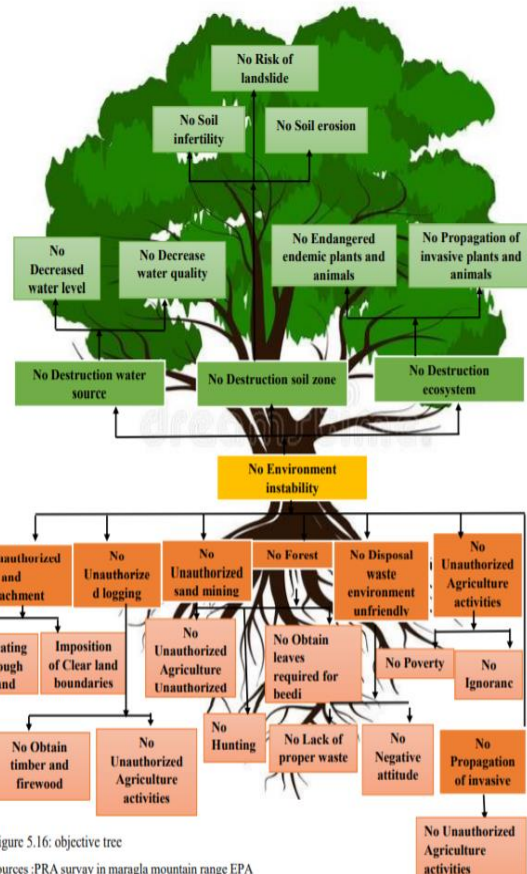


Figure 5.16: objective tree sources :PRA survey in maragla mountain range EPA

63

Figure 7: Problem tree

Figure 8: Objective tree

Sources: PRA survey in Maragala mountain range

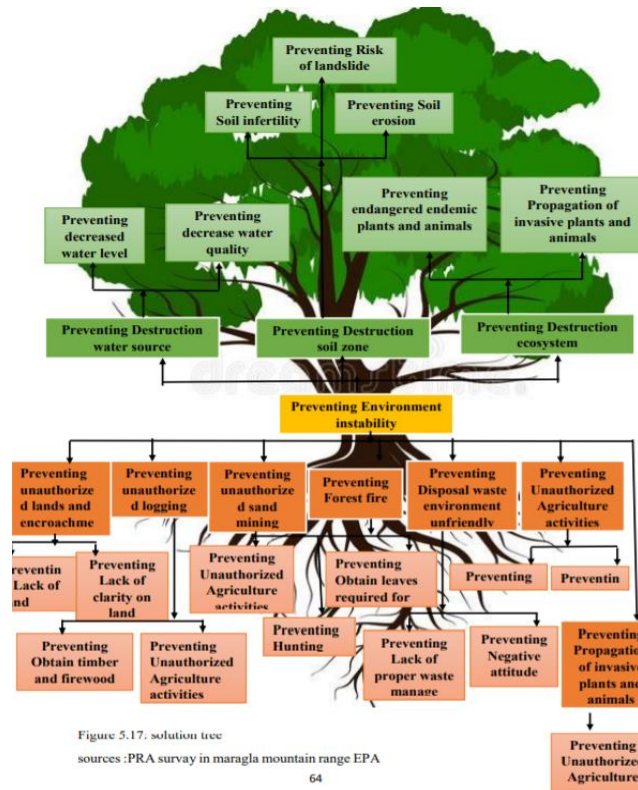


Figure 5.17: solution tree sources :PRA survey in maragla mountain range EPA

64

Figure 9: Solution tree

Sources: PRA survey in Maragala mountain range

Activities plan

An activities plan (Table 7) is a plan of action taken to solve a major problem. The problem is designed to minimize the impact on the environment due to the unauthorized

activities in Maragala EPA. A setup process can be done to prevent the environment from becoming destabilizing due to the causes of environmental destabilization. It can be concluded that by taking action to prevent this, the threat to this ecosystem can be minimized and protected.

Table 7: Activity plan

Problem	Activities	Period	Responsibility	Implementers
Unauthorized logging	1. Take active legal action against unauthorized logging.	Medium-term	Forest conservation department	Maragala surakimu committee
	2. Planting of plants that affect water generation and purification in relation to water sources.	Short term	Non-government organization, water board	
	3. To make the community aware of the special importance of the plants in this area.	Short term	Central environment authority.	
	4. Granting permission to cut down trees only for essential reasons.	Short term	Divisional secretary office	
Forest fire	1. Determining areas of immediate forest fire.	Medium-term	Forest conservation department	Maragala surakimu committee
	2. Introducing the fire belt concept.	Long term	Disaster management unit	
	3. Take active legal action against forest fires	Medium-term	Disaster management unit	
	4. Raising awareness among the locals and world community about the biodiversity of this area.	Short term	Central environment authority	
	5. Preparation of a program to control the spread of pine in the upper part	Short term	Disaster management unit	
	6. To make the visitors aware of the importance of enjoying the beauty of the environment with proper management.	Short term	Department of tourism	
	7. Disruption of agriculture practices with forest fire	Short term	Department of Agriculture	
Unauthorized agriculture activities	1. Introducing the concept of agroforestry to the residents.	Medium-term	Department of Agriculture	Maragala surakimu committee
	2. Taking legal action against persons engaged in agricultural activities in areas above 1000ft.	Short term	Central environment authority	
	3. Introducing another source of income instead of agriculture.	Medium-term	Ministry of traditional and small enterprises	
	4. Informing the residents about the use of organic manure and the preparation of organic manure at home.	Short term	Department of Agriculture	
	5. Providing training on sustainable cultivation.	Medium-term	Department of Agriculture	

Unauthorized land and encroachment	<ol style="list-style-type: none"> 1. Granting proper lands to the unauthorized land profits and evicting people from the upper part of the Maragala mountain range EPA and resetting them in an area full of human habitable infrastructure. 2. Resettlement of persons who have unauthorized settled in the plantation area. 3. Taking legal action against unauthorized land and unauthorized occupants in these areas. 	<p>Long term</p> <p>Long term</p> <p>Medium-term</p>	<p>Land reform commission</p> <p>Divisional secretary office</p> <p>Divisional secretary office</p>	<p>Maragala surakimu committee</p>
Propagation of invasive plants and animals	<ol style="list-style-type: none"> 1. Identify the area where invasive plants and animals have spread and control their spread beyond. 2. Raising awareness among the residents about invasive species and taking action to eradicate those plants. 3. Take steps to systematically eradicate invasive species from the area. 4. Utilization of technology to reduce the spread of invasive plants in upper forest areas. 5. identify areas with endemic fauna and flora, and demarcate that area as high-security zones. (wildlife reserve) 6. Preparation of activities required for the growth of endemic plants and animals. 	<p>Long term</p> <p>Short term</p> <p>Short term</p> <p>Long term</p> <p>Medium-term</p> <p>Medium-term</p>	<p>Forest conservation department</p> <p>Forest conservation department</p> <p>Forest conservation department</p> <p>Central environment authority</p> <p>Forest conservation department</p> <p>Central environment authority</p>	<p>Maragala surakimu committee</p> <p>Maragala surakimu committee</p>
Disposal of solid waste and wastewater environment unfriendly	<ol style="list-style-type: none"> 1. prior to the application of organic matter instead of the use of chemicals for agricultural purposes. 2. Providing adequate toilet facilities and maintaining them properly. 3. Awareness of proper utilization of water resources. 4. Develop a long-term plan to minimize the impact of water sources due to estate settlement and implement it properly. 5. Develop a proper waste disposal process. 6. Implementing a program to make the residents of the area aware of the benefits of decomposing materials. 	<p>Short term</p> <p>Medium-term</p> <p>Short term</p> <p>Medium-term</p> <p>Short term</p> <p>Short term</p>	<p>Department of Agriculture</p> <p>Divisional secretary office</p> <p>Water board</p> <p>Janatha estate development board</p> <p>Divisional secretary office</p> <p>Central environment authority</p>	<p>Maragala surakimu committee</p>

Unauthorized Sand mining	1. Taking legal action against Unauthorized Sand miners.	Short term	Divisional secretary office	Maragala surakimu committee
	2. Awareness about the impact of sand mining in this area than other areas and the indirect effect on residents.	Short term	Central environment authority	
Hunting	1. Awareness of the impact on ecosystems due to activities such as arson for hunting.	Short term	Central environment authority	Maragala surakimu committee
	2. Taking legal action.	Medium-term	Central environment authority	
Unauthorized collection of animals and plants	1. Awareness of the Community about the importance of plants and animals in this area.	Medium-term	Forest conservation department	Maragala surakimu committee
	2. Expanding the powers of the forest department and wildlife center.	long term	-	
Other issues (landslide risk)	1. Determining landslide-threatened areas.	Medium-term	National building research organization	Maragala surakimu committee
	2. awareness of the community about soil conservation method	Short term	Agriculture department	
	3. build an alarm in the landslide risk area	Medium-term	National building research	
Ignorance and poverty	1. Implementing an awareness program for the residents of this area about the importance of this area compared to other areas.	Short term	Forest conservation department, central environment authority	Maragala surakimu committee
	2. presenting a media program on this ecosystem for the benefit of all Sri Lankans	Short term	Forest conservation department, central environment authority	

Zoning concept for Maragala mountain range EPA minimizes environment impacts due to unauthorized activities.

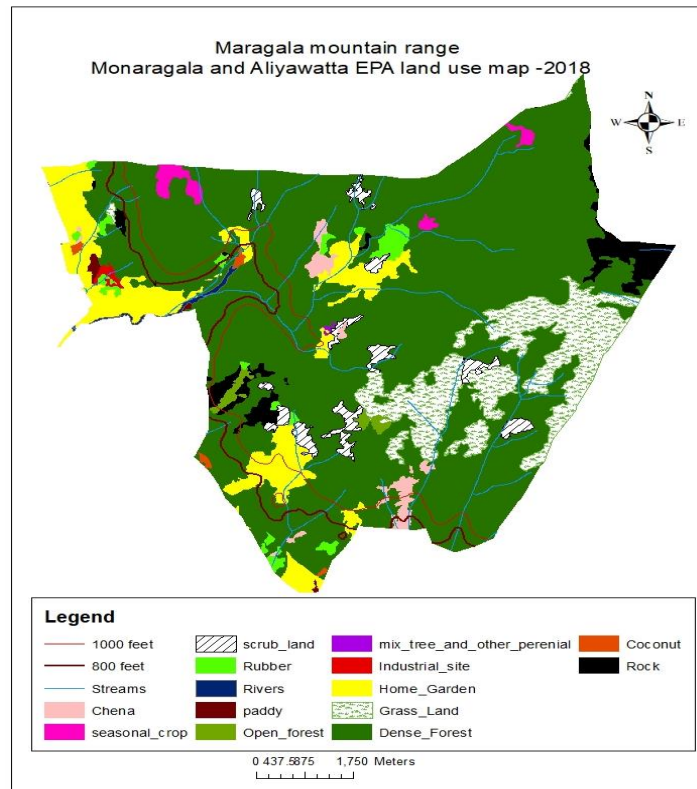


Figure 10: Zoning map
Sources: land use data, 2018

The zoning concept is proposed that the Maragala mountain range EPA is divided into three zones, to minimize the Environment impact due to the unauthorized activities. The sensitive zone (1 zone) is distributed to the area above 304m to a high level of protection. It includes natural vegetation types within endemic flora and fauna species. This zone is not entered for human activities, or permitted for other activities. It should be converted into a wildlife protection zone. The intermediate zone (2 zones) is distributed between 203m-304m. intermediate (middle) zone is a buffer. It can implement human activities within forest areas. It is not doing any environmentally harmful activities and Permitted activity can implement this zone, and establish a water project. People currently living in the upper part (sensitive zone) have the potential to settle in this zone. This zone provides an additional layer of environmental protection to the sensitive zone due to unauthorized activities. The social and economic zone (3 zones) lies below 204m extending to the boundary of the Maragala mountain range EPA. It can implement economic activities, cultivate lands (seasonal crops, chena cultivation), and small business establishments. This area has no more restrictions for human activities. But no permission for environmental impact due to the unauthorized activities.

In doing this research, it was possible to get a wealth of new knowledge, mainly to identify the unauthorized activities in Maragala mountain. There, illegal agricultural activities are a strong factor. Although doing agricultural activities is not considered an unauthorized activity, all agricultural activities carried out in areas higher than 1000ft are called unauthorized agricultural activities due to the fact that this Maragala mountain area is a highly sensitive ecological zone. Although hay cultivation, paddy cultivation, and gardening are considered as normal activities in normal areas, such

activities are known as unauthorized activities in the Maragala mountain area.

CONCLUSION

In this research, studies have been conducted on “identifying the Environment impact due to the unauthorized activities”. During the analysis of the data, a number of issues were identified regarding the environmental impact on the Maragala mountain range EPA due to unauthorized activities. Depletion of water resources is one of the major environmental impacts that can be seen in these areas. According to the sample survey, 89% of residents confirm that the water sources have become depleted, and the water springs have dried up. Small water sources dried while large water sources as water pits in the dry season. The quality of the water has also declined. After the precipitation, the water is not suitable for drinking. Accordingly, it was identified how the environmental impact of the Maragala mountain range EPA has been affected by the destruction of water sources.

Field observations identified a distribution of invasive plants and animals in the area. it is found in abundance in agricultural lands and is found in invasive plants scattered throughout the highlands and is widespread in the low land. Endemic flora and fauna also declined in growth and distribution. Investigations by CEA have identified a number of threatened species in the area. There have also been reports of illegal animal collection and animal hunting has slightly spread the area. Looking at these facts, it is clear how the local ecosystems have been affected. it identified the environmental impact on the Maragala mountain range.

The impact of the soil zone on this field was identified through sampling observation. There was soil erosion, risk of landslide and soil fragmentation, and soil infertility. Landslides are reported in the western and southern part of

the Maragala mountain range EPA which is about 62% according to the residents. Soil erosion was also reported in the area abounding Geloon mountain.

Many unauthorized activities in the Maragala mountain range EPA can be identified by observation and discussion. This area is named EPA according to the gazette notification dated 2008/08/01. unauthorized activities have been identified through permitting activities. unauthorized logging, forest fire, unauthorized sand mining, unauthorized agriculture activities, adversary disposal contamination water to water sources, the proliferation of invasive plants and animals, unauthorized land, and encroachment find as unauthorized activities.

A rapid increase in large-scale forest fires in 2019. The forest fires that occurred on 29/8/2019 have spread to the upper part of the mountain, affecting the forest as well as threatening the catchment area. And small forest fires are common incidents annually. It spreads due to dry weather and winds. The purpose of forest fire is to prepare lands for agricultural activities, to obtain leaves for 73 beedi production, encroachments. Currently, a forest fire is one of the major unauthorized activities in the Maragala mountain range EPA (deparment, disaster management, 2019). One of the major factors influencing the presence of plantation settlements in the highlands. They are prone to these e unauthorized activities due to poverty and the lack of public awareness of the Maragala mountain region EPA. Due to the high population density of the Monaragala city area.it is currently expanding towards a 1000ft boundary area. The destruction of water resources in the area can be minimized by evicting the plantation people in the upland area and resettlement them to a place that is convenient for their economic status and employment.in addition, the impact on the ecosystem and the soil zone can be avoided. This will prevent unauthorized activities and reduces the environmental impact of the Maragala mountain range. According to the PRA survey, identified the problems, identified problems objectives, find solutions and can mitigation plan to minimize the environmental impact of unauthorized activities in the Maragala mountain range EPA Recommendations are granting proper lands to the unauthorized land profits and evicting people from the upper part of the Maragala mountain range EPA and resetting them in an area full of human habitable infrastructure, Taking legal action against unauthorized land and unauthorized occupants in these areas, Planting of plants that affect water generation and purification in relation to water sources, Determining areas of immediate forest fire and Introducing fire belt concept huge forest fire area, introducing the concept of agroforestry to the residence, Develop a long term plan to minimize the impact of water source due to estate settlement and implement it properly. This research indicated effects of unauthorized activities in mountain ranges and forest fires hugely damage the environment in a short time period. And also adverse human activities directly decrease environmental quality. Based on the findings of this study, it may be suggested that the following research be conducted in the future. Such as Impacts on the ecosystem due to human activities in mountain areas. An examination of the environmental impacts of forest fire, Study of the economic hardships of people living in the mountain upper part.

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