OPEN ACCESS JOURNALS
Indiana Journal of Agriculture and Life Sciences
Abbriviate Tittle- Ind J Agri Life Sci
ISSN *(Online)*- xxxx-xxxx
Journal Homepage Link- https://indianapublications.com/journal/IJALS

INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Research Article

Volume-01|Issue-01|2021

Impacts of Flood Disaster on Agricultural Lands of Mawadippalli Area, Ampara

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Article History
Received: 02.09.2021
Accepted: 28.09.2021
Published: 15.10.2021

Citation
Banu, M. N. N. (2021). Impacts of Flood Disaster on Agricultural Lands of Mawadippalli Area, Ampara. *Indiana Journal of Agriculture and Life Sciences*, *1*(1), 29-38.

Abstract: *Flood is a common portent in Mawadippalli, which affects paddy output. The fact is that the tributary of Galoya- Pallaru River overflows during the torrential downfall of the North-East monsoon and results in the adverse flood scenario across the village Mawadippalli. Cultivators are generally affected by weak flood deluge handling strategies and pre-forestallment measures. Thus, this research aims to identify the effects of flood disaster on the agricultural lands of the Mawadippalli area. Observation, interviews, and questionnaires were used to collect the data, and reports, published articles were the secondary information for the study. The collected data were interpreted by descriptive analysis, and MS Excel, Google earth pro and ArcGIS 10.3 were utilized for the analysis. The drizzle downpour and rice production have a strong bond between them. Agriculture plays a major role in the village's husbandry. Mawadippalli is a small town let encircled by paddy lands, and outside of the cultivators rely on it for their livelihood. Albeit, historically, disasters influence agrarian exertion. Therefore, the proposed recommendations will be beneficial in minimizing the estimated losses and effects of the flood in the study area, such as allocating agricultural insurance for farmers, using sandbags to direct water flow, creating natural systems along the Galoya aqueduct basin and so on.*

Keywords: Agriculture, Rainfall, Farmers, Flood, Overflows.

INTRODUCTION

Agriculture is one of the fundamental economic activities across the world. Flooding is a severe burning issue that the world is facing in every nook and corner. Upali *et al.* (2020) expounded that about 74% of these natural hazards were related to water. Brian & Stephane (2019) recognized that conforming to the World Bank post-disaster needs assessment, the government disbursed US$6.6 million in emergency relief, and total recovery needs were later estimated at nearly US$800 million. Floods and storms accounted for 69% of the financial damages, exposing over three billion people and causing 166,000 deaths globally (Upali *et al.*, 2020). Jasmine (2019) stated that thousands of people die, millions become homeless, and properties and infrastructures are extensively damaged by the calamities of flood every year worldwide. Bremond *et al.* (2013) noted that land use depends on flood frequency in Agriculture. Sahab *et al.* (2008) reported that farmers are routinely exposed to various natural disasters, erratic rainfall and pests, for example, farmers are confronted with heavy rains, floods, pests and diseases, droughts, and market price fluctuations (Sahab *et al.*, 2008). In worldwide, flood is dangerous natural hazards which damage the environment and human settlement. Hence, farmers depend on agricultural activities and productions heavily influenced by rainfall and flood. Haruhisa & Jun (2009) mentioned as climatic factors (such as climatic trends and random variability in the system) and no climatic factors (such as yield technology and changes in data accuracy) contribute to the non-stationary of the weather-yield relationship. Usually, the main crops cultivated and farmers' practices are adapted to a given flood frequency. Between 2000 and 2020, south Asia alone experienced 11% of the world's natural disasters and 12% of floods and droughts, exposing over 700 million people and 190 million ha of agricultural lands (Upali *et al.*, 2020).Mathanraj & Kaleel (2016) clarified that rainfall is a key determinant of the growing seasons and the type of agriculture practiced as well rainfall plays an important role in agriculture as any shortages or excesses of precipitation gives way to a decrease in yields, for instance, rice is the main crop in Sri Lanka and is highly vulnerable to rainfall variability.

The rainfall intensity varies markedly across the island (Mathanraj & Kaleel, 2017). Sri Lanka receives rainfall in three ways, such as monsoonal rainfall, convectional rainfall, and depression rainfall. This rainfall has taken a specific period annually. Kaleel (2018) exposed that depression rainfall also occurs during the inter-monsoon periods, particularly during the second inter monsoon (October to November). Erica (2013) mentioned that during the year, the island is hit by the Southwest- and Northeast monsoon and the irregular rainfall is, as a consequence, problematic for agriculture because it contributes to severe droughts and floods. Maria *et al.* (2018) recognized that climate and sea-level rise will seriously impact the natural environment and human society in the coastal zone. According to Chandrasekara *et al.* (2018), coastal communities, their livelihoods, and the coastal ecosystems of Sri Lanka are vulnerable to extreme rainfall events. Moreover, food security is the most important one to stabilize a country far from starvation, but the lack of food security can cause starvation and

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famine, resulting in the country's economy. Hazran *et al.* (2017) have noted that a consistent supply of agricultural products such as stable food and meat is needed to feed seven billion people globally.

According to the Government's Rice Research & Development Institute (RRDI), about 1.8 million farm families grow paddy, known as rice, once harvested (Thayalini, 2018). Sandika *et al.* (2009) mentioned that rice is the principal contributor of the rural economy as the majority (72%) of rural households are engaged in rice production as their primary and supplementary source of livelihood. Rasmy & Naseer (2005) noted that Sri Lanka is an agricultural country where one-third of the land is used for agriculture and contributed LKR million 237,311 to the GDP of Sri Lanka in 2003. On the other hand, Kajananthan & Achchuthan (2013) noted that the agricultural sector in Sri Lanka contributes nearly 12 % to the country's GDP and employs 33 % of its labour force. Thiruchelvem (2005) explored that the total amount of rice needed in 2005, 2010, and 2020 is estimated at 3.23, 3.46, and 3.83 million metric tons,respectively. Adhikarinayake (2005) reported that although the government invests in the rice sector for economic reasons, at- farm level, the profit margins have sharply declined, namely labour, farm, fertiliser, and agrochemicals demand about 90% of the total yield, thus the share of labor component is about 45%. Sri Lanka has 103 rivers; among them, 10 rivers are identified as major indeed. Thus, the flood has a specific concern in Sri Lanka as it is a common occurrence annually. North, north-central and eastern provinces are severely affected by the monsoon rain annually.

The study area is situated in the Ampara district. This place is coming under the dry zone of Sri Lanka, which experiences less than 1750 mm rainfall annually during the northeast monsoon period. Accordingly, the Ampara district is one of the wealthiest districts in paddy production. Lebbe (2010) indicated that of the total population of the district Ampara, around 45 per cent are directly involved in paddy cultivation and production, and another 35% are indirectly involved. This district has 16 per cent of the total cultivable lands in Sri Lanka (Lebbe, 2010). The spate repercussion is the probability of the effectual level, mainly in the northeast monsoon epoch. Some issues bring spates, and their impact also heavily affects the land, people, plantation, etc. Mostly, this study area has a traditional agricultural land-use practice that helps the agricultural lands and its husbandry productivity in a high echelon in recent decades. Hence, some factors swayed the productive level of paddy in the most prominent climatic factors. Ampara district is one of the major paddy cultivating district, and it provides more than 16 per cent of the total paddy production in Sri Lanka (Kajananthan & Achchuthan, 2013). The village Mawadippalli severely experiences flood during the Northeast monsoon annually. The study area is conquered by flooding by the Tributary of Galoya River. Thus, agronomists who engage with agricultural conditioning in the study area influence the consequences of the flood, such as socioeconomic impact. Gal Oya is the 16th longest waterway in Sri Lanka, and it begins from the eastern hills of Badulla ultimately ended in the South of Kalmunai, the Indian Ocean. It consists of 108 km (67 miles) length in South East of Sri Lanka. SenanayakeSamudra is currently known as Galoya reservoir, and it is exceptional compared with other reservoirs in Sri Lanka in multiple etiquettes. Irrigation water is provided for 120000 cultivated lands by way of left, and proper forms left canal way, and proper canal way is 32 miles in size and 22 miles in length, respectively.

MATERIALS AND METHOD

Description of Study Area

The residential ranks in the study area are in altitudinous elevations rather than agricultural lands. The imagery of the research area (image 1) is reclaimed from Google Earth Pro and is assayed by ArcGIS10.3. The village Mawadippalli is advancing under Karaitheivu Divisional Secretariat Division, Ampara, in Eastern province as well Figure 1 includes district and DSD of the studyarea. The land use of the study area shows bare plots, home gardens, industrial areas, residential places, paddy fields, river and other minor legends.

When considering the subject area, the monsoon seasons engross a vital place for conferring an ample measure of rain. Alike the research area admitting cloudburst by convection rain during the inter-monsoon seasons requires much rainfall through the North-East monsoon season from December to February. Sammanthurai, Kalmunai, Veeramunai, Erakkamam, and Akkaraipatru areas heavily engage in paddy cultivation, including a small village Mavadippalli.

Even though these places are highly productive in paddy cultivation in the Ampara district, due to the monsoonal reversal, especially north-east monsoon, the flood is partially occurring, and farmers are suffering from the impact caused by it. Therefore, no research has not been proposed yet regarding the agricultural activities, climate revolution, and their cause and effects in the Mavadippalli area. This research was done to attain the gaps as the obstacles encroach in the paddy fields and influence the productive level and propose suitable strategies to overcome these problems in the Mavadippalli area. There are some critical issues regarding the causes and the effects of overflow in this field. Mavadippalli is facing several challenges due to the flooding inundation of paddy lands, river banks and residential properties. Thus, the populations depending on the agricultural endeavors and the farmers in this territory are mostly affected by the rainfall variability.

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Agricultural activities in this space depend on rainfall, whose distortion has caused adverse effects on crop production. This flood causes crop and environmental damages, water quality reduction, effects on crop production, removal of vegetation, and the displacement of populations living in the surrounding area.

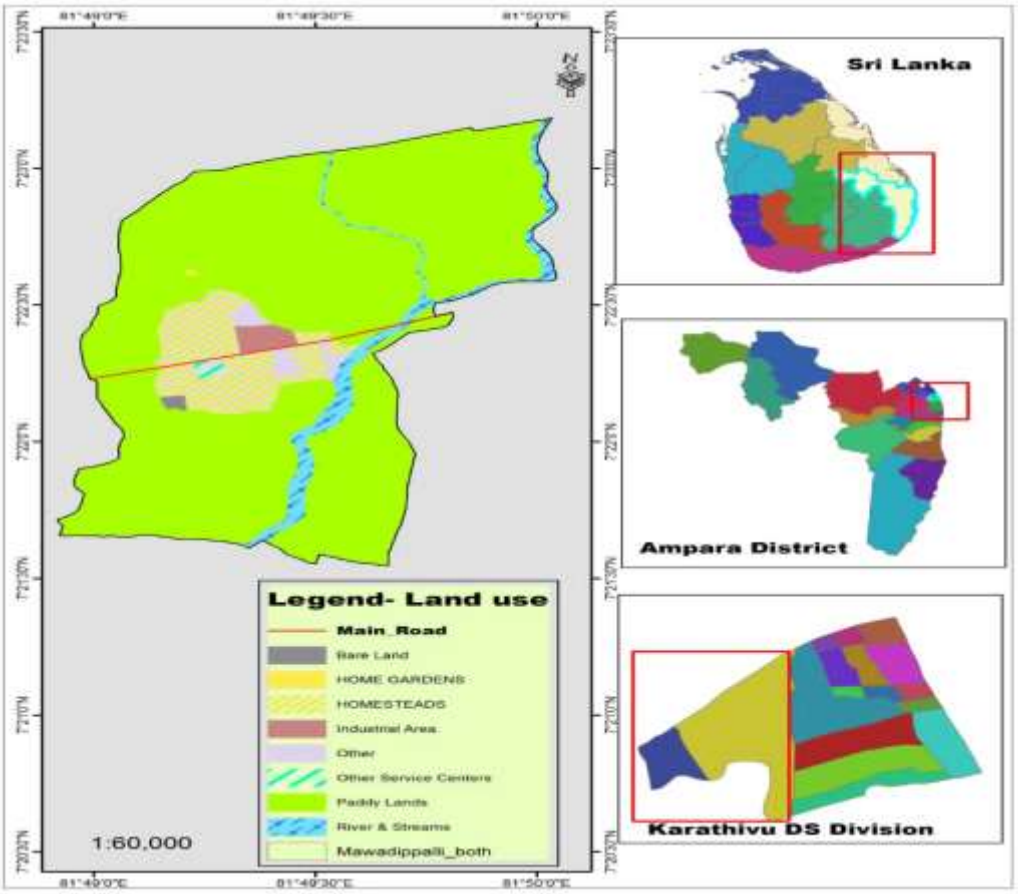

Figure 1. The study area of Mawadippalli
Source: Google Earth Pro & ArcGIS

Data Collection

Table 1: Floods in Ampara District

Divisional Secretariat Divisions	GramaNiladhari Divisions
Kalmunai	Kalmunai MD 1, Kalmunai 1
Nintavur	Malayadigrama T1, Ninthavur 4
Sainthamaruthu	Sainthamaruthu- 03, 04, 07, 09, 10, 11, 12, 14, 16
Karaitheivu	Karaitheivu- 01, 02, 06, 07, 10, 11, Mawadippalli.

Source: Interview with GramaNilathari.

Table 01 shows the divisional secretariat divisions that are subjected to flood in the Ampara district. Under the Karaitheivu DSD, the study area Mawadippalli is alike conquered to the allusion in nature. As Mawadippalli is revealing a considerable volume of copious water for irrigation from the taking off aqueduct of SenanayakeSamuthraya, the paddy production is likewise rich presently. Thus, this research is forecast to clarify the inconsistency of how the flood affects agricultural lands and the arterials of mitigation. Identifying the effects on agricultural lands is a must by the flood, and no research and article were executed about the content until now. The main aim evaluates added valuation to determine the principal effects of flood in agrarian lands of the Mawadippalli- Ampara District.

Data Analysis

Nquot&Kulathunga (2014) give a simple illustration for the flash flood: the flash flood is usually sudden and unexpected, arising from the heavy and persistent downpour. As the study is leaned on flash floods in the study area, tremendous efforts were put to gather accurate inputs. The methodology of this paper is propped on primary and secondary inputs collection techniques. Observation, interviews, and questionnaires were utilized for the primary data. At the same time, the varied sources of articles about this theme, data

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collected from the Divisional Secretariat Office Karaitheivu, newspapers, reports, and surveys were used as the secondary data for this paper as well the researcher used both qualitative and quantitative methods in nature.

$$\frac{3155}{100} * 3 = 93.66$$

The random sampling method distributed 93 questionnaires. Namely, 10 queries were allocated to the DS Officer, 10 questions were given to GN Officers (east &west of Mawadippalli), 15 questions were set aside for householders, and it earmarked 15 questions for passengers and villagers. Thus, the data collection predicted the husbandry and crop sectors. The survey domesticates face to face with the guided questionnaire. Farmers' profile, farmers' insights on the impacts of flood in the agricultural loss, and respondents' profile were considered in the survey. The collected data were employed to illuminating interpretation and figured using MS Excel, Google earth pro, and ArcGIS 10.3.

Disaster Risk Criteria for Flood- Hazard

The data were subdivided into distinct thematic categories to define and examine the major topics of the research independently. Fundamentally, data analysis was based on themes and interpreted correspondingly. Thus, table 2 represents that the catastrophe yardsticks for the study area. Namely, the study area has been classified into 4 criteria for the flooding effect. Accordingly, the top level of the flood is < 6ft, <5ft is mentioned as high-level flooding, moderate flood is more than 4ft, and the low level of the torrent is <3ft. Hence, the study area experiences these four kinds of disaster risk while flooding takes place.

Table 2: Disaster Risk Criteria

Disaster Vulnerability Map	**Disaster Risk Criteria**			
	Very High	**High**	**Moderate**	**Low**
Flood	<6ft	<5ft	<4ft	<3ft

RESULTS AND DISCUSSION

Moisture Content of Soil

The solidity of the water content in paddy or rice stated in percentage is the soil's water content. Even though the soil moisture content varies according to the type of soil. Specifically, the discrepancy emerges from the first meter below the surface. The below pie chart 3 represents the sandy soil from 3% to 10%, the driest condition to the wettest field capacity, or 20% to 40% in clay soil. Low soil moisture for clay is below 60. 80-100% of moisture does not need water irrigation to be applied. Thus, during the flood, the pH level is increased in clay sand. Thus, it maintains the soluble and highly alkaline stage of ph. The alkaline and extremely alkaline stage of pH are 8-9, 9-14, respectively. Albeit, if it reaches the highly acid or highly soluble situation, it tends to be hard and sticky, thus, leads too hard to cultivate on that land.

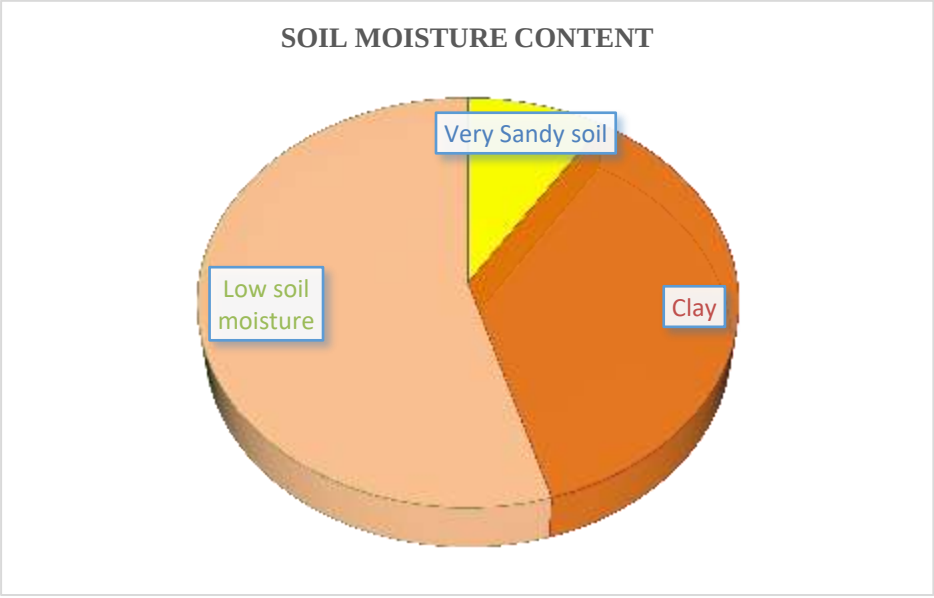

Figure 2. Soil moisture content
Source: Agrarian Department Karaitheivu

Impact the Survival of Invertebrates

One of the most significant reservoirs of biodiversity is in the soil. The soil fauna is another important creature/ beast and biodiversity, which plays an essential role in multicolored functions for the soil ecosystem. Either, the soil quality also enhances by

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them. For illustration, soil micro arthropods, the earth warms, small mites, insects and snails. These faunas cannot survive under flood conditions; thus, the fluctuating/ mutating water rank has the implicit in eliminating the continuation of the invertebrates and insects in the paddy lands. The production rate is reduced by the low soil quality depressed the survival of the microfauna.

Weed

As paddy cultivation is the livelihood of the research area, most of the families count on this rural income. Due to the flooding in the paddy lands, cultivators are reluctant to invest mostly in the Maha season rather than the Yale season. By the exacerbation diffident of the weeds, these weeds are compiled into the paddy lands. Thus, the weeds dominate the paddy lands. This slows down the growth of crops and enhances the growth of weed seeds. It leads to a reduction in overall production. TyphaAngustifolia, Yellow Core, Horse grass, Triangular ax, are the weeds that occupy the paddy lands in the Mawadippalli area. Thus, this vulnerable situation sustains during and after the harvest. Farmers spend farther have to clear these weeds by paying salaries/ payments to the diurnal workers presently. The below image 4 depicts the dominance of weeds after subdued to inundation in the study area. These weeds dragged and accumulated by the excess inrush of floodwater, thus, causes multiple problems to the farmers and during the husbandry activities. This is how the adverse effect of the inundation is taken place in the study area.

Figure 3. Dominance of weeds in agricultural lands in Mawadippalli.
Source: Direct Observation by the researcher.

Poor Soil Aeration

Ventilation and aeration are important phenomena during the growth of a plant. Mostly it is needed for the plants which survive in the low-lying wetland areas because they often suffocate for oxygen. Further, the flood inundation reduces,

- The oxygen level is reduced by water saturation and stagnating in the paddy fields notably.
- The flood alters the soil structure.
- Deflocculation of clay.
- The rate of decomposition of organic matter is decreased.
- Accumulation of toxic components in the lands.

Figure 4. Dominance of flood, which results in poor aeration.
Source: Direct Observation by the researcher.

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A farmer stated that when the water traps during the flood for over 7 days–10 days definitely these plants will rot without getting proper oxygen for root respiration. The grown crops and less mature plants submerged underwater too long undergo poor aeration and eventually die. The above figure 4 shows the encroachment of floodwater. It saturated and stagnated in the agricultural fields; thus, the plants could not get aeration for the plant's growth. In the end, it destroyed all the paddy plantations; thus, this is how the encroachment of floodwater in the agricultural paddy fields in the Mawadippalli area.

Figure 5. Affected agricultural lands in Mawadippalli
Source: Direct Observation by the researcher.

Imbalance of Nutrient Uptake and Toxic Components

This image is of the affected agricultural regions in the study area, Mawadippalli. Through root respiration, the vegetation attains energy to grow. But, the paddy fields in the study area under excess flood water conditions award lack of aeration to roots, and it utterly disturbs the consumption of nutrients. Nutrients like P, Mg, Ca, N, and K are the major ones that contribute their hundred percentage. Ono (2012) demonstrated that flooding induces significant modifications in the chemical and microbiological environment of the soil, and it is assumed that these variations may affect the mineralization process of soil organic N. Flooding reduces the redox potential of the soil. It increases the pH of soil acid. This occurs mainly because of the alteration of Fe^{3+} to Fe^{2+}.The soil pH alkaline decreases due to the accumulation of CO_2, which creates H_2 CO_3 in the end. Harmful components such as ethanol, acetaldehyde and cyanogenic are accumulated in flooded lands generally. The soluble nutrients like manganese and iron increase the toxic level in the plantation when it builds up in its amount.

Disease

Flood has the potential to reduce the amount of oxygen in the soil. The air-filled pores are 10-30% in general. It decreases when the earth's water saturates it. When the soil is covered with overdressed moisture, there is dehydration in the paddy plants. Bare roots without oxygen suffocate to get aeration, and this situation leads to starvation in plants. Continuous floods in headlands induce stresses in those plants. Overdressed moisture and humidity cause disease in plants. Moisture and humidity imbue the terrible sectors of water characters and enhance the growth of microorganisms like bacteria, fungus, nematodes in plants. Pathogens also lead to diseases in plants. Brown Plant Hopper (BPH), Stem borer, paddy bundle pest, and leaf and sheath mites are the pathogens or pests which cause foot rot disease, rice blast, sheath rot, sheath blight, and brown spot in paddy unless the farmers cannot identify the pathogen and did not do any proper management activity to control them.

Changes in Cropping Pattern

The affected paddy lands have a very momentous time to recuperate. Thereby, the farmers are incompetent to cultivate the lands in time. The west part of the study area occupies 343 acres of paddy lands as well the east part of the study area also has 284 acres of paddy lands. By the Pallaru, a tributary of Galoya, overflow the water during flood causes enormous flood around these specified lands. Thus, it takes time to heal. Corresponding to figure 6, the disaster vulnerability is severe in the latter year 2020. The blue stain manifests a severe spate, which is 6ft (~2.2m) above in the study area. As well, the red color shows a high flood scenario with 5ft (1.6 m) above. < 4ft (1.3), and < 3ft (0.95m) mention the moderated flooding and nominal level of flooding, respectively, in the study field.

According to a cultivator's view through the interview, it is not possible to cultivate paddy appropriately when it's heavy raining. Thus, the farmers should bide for at least 3 weeks to 4 weeks (1 month).

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Notwithstanding, there is no possibility to sow paddy seeds in time for the season if the rainy period extends. Thus, that season might be left alone, and the farmers engage in farming with the ensuring season. So, this is the fact and fate of farmers when flooding ensues due to heavy rain. The livelihood of farmers also affected by this adverse ruthlessness.

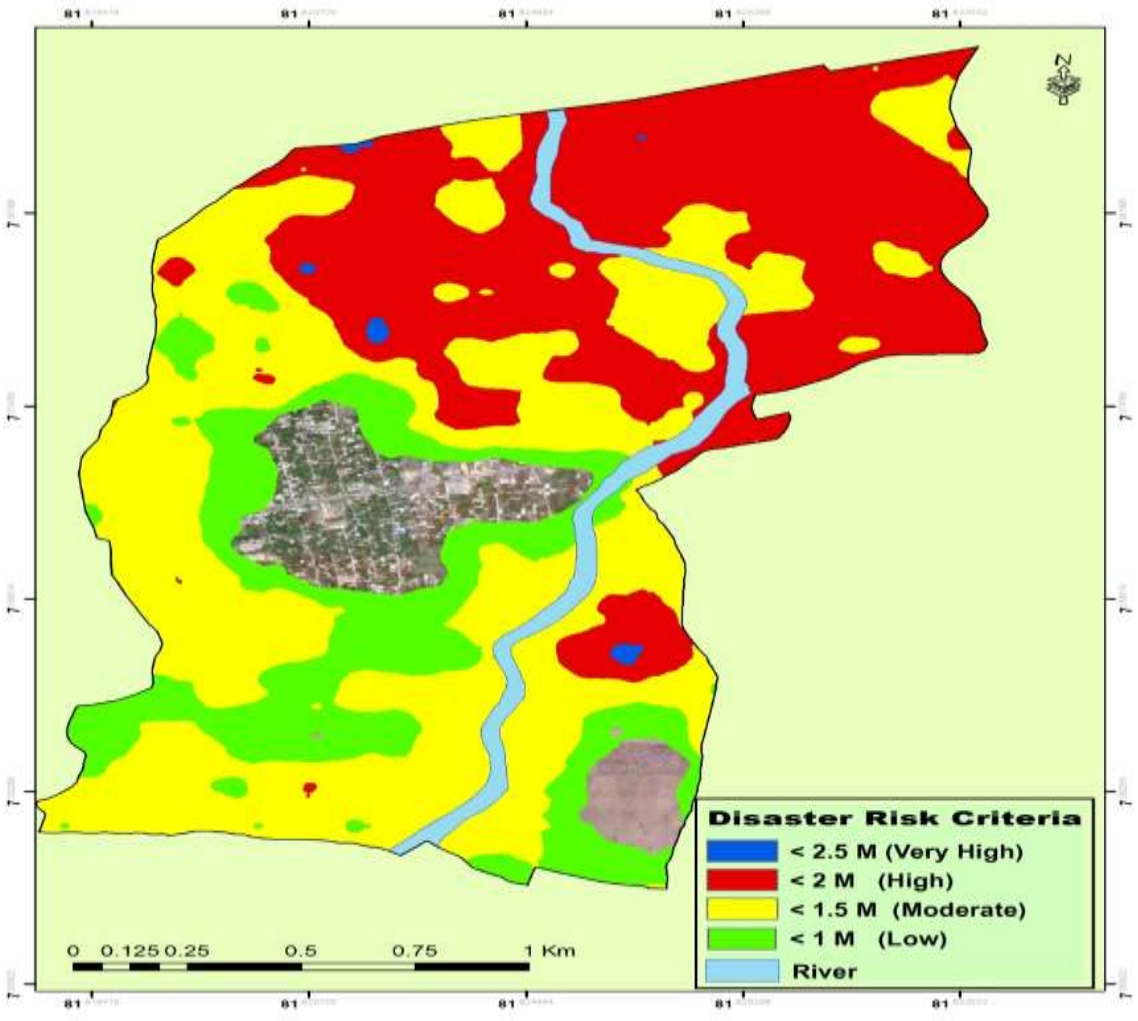

Figure 6. Disaster Vulnerability Map of Mawadippalli-2020
Source: Retrieved from ArcGIS 10.3

Sedimentation

The floodwater accumulates debris in the fields favorable to the recoupment of lands after floods while ploughing the lands for cultivation. These sediments do reinforce the soil resource in the fields as biological fertilizers. Either, these rice lands are to act as traps for incoming sediments. But, all the sediments which ambush in the field will not pursue permanently deposited; instead, a portion of them are eliminated in the name of planting and weeding.

Water Recharge for Dry places of Paddy Lands

The agricultural activities and livelihood of people in the study area depend on the tributary Pallaru stream. In comparison, the high-risk zones are around the stream <6ft (<2.5m), the medium and low flood areas get wet by the monsoon rain rather than the water overflow from the river in the fields. On the other hand, the lands far from the tributary are receiving water for agriculture by the canals across these lands. Hence, the canal water supply delays reaching the fields, which are the farthest. An interviewer mentioned that 10 - 14 days are needed to the water reach at least 1-mile distance on typical days of each year. Thus, like these situations, the river overflow mostly inundates the lands, which help to make the land for ploughing after the rainy season.

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Low Yield

Figure 7. Agricultural lands Affected by Flood in Mawadippalli
Source: Direct Observation by Researcher

These figures 7 manifests the causes of the yield devaluation in the study area by the flood. Image 8 represents the implements of flood concerning residential areas. The well-cultivated crops were destroyed, expected to overflow and excess rainwater saturated in the cultivated lands, thus absolutely impaired aggregative fertility of this area. The yield is depending on the degree of the flood and the age of the paddy. Probably, as a flood occurs during the Maha season (December - February), paddies are affected in their earlier immature stage. Compare with Yale season, and the yield is low in Maha season in the study area. Therefore, the flood regulates the cost of cultivation, quality of yields, and outcome of paddy production.

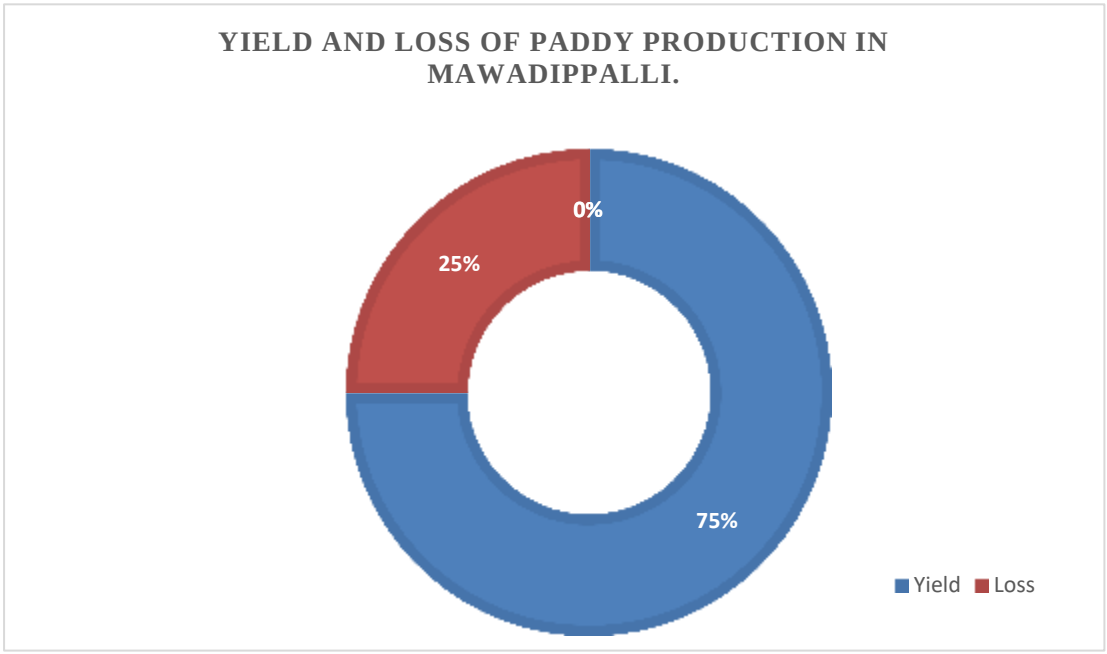

Figure 8. Comparison of yield and loss in a season
Source: A questionnaire survey

This pie chart outlines the comparison between yield and loss in a season of paddy cultivation in the study area. The harvest for an acre is approximately (40 bags) 2640kg. Thereby, the total 626 acres have got ~1,652,640 kg (1820 tons) of harvest from the study area, Mawadippalli. At the same time, the loss is also estimated as an acre has (15 bags) 990kg become useless or lost due to the flood. Thereby, the estimated total loss is ~619,740 kg (682.5 tons). Thus, this small area of paddy cultivation dominates the overall paddy production of Sri Lanka as well.

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CONCLUSION

Agriculture is the most prominent occupation around the world. The consumption rate and desirable food items dominate the farming system. Thus, this study mainly focuses on the flood hazard and its influence on the agricultural paddy lands. As the farmers rely on seasonal rainfall for cultivation, the yield is rich in Maha season rather than Yale season in the study area Mawadippalli.On the other hand, the seasonal rainfall of the Maha season causes flood events by the tributary of the Pallaru River. Thus, this causes 25% of the overall estimated loss in the study area only. Therefore, this study will aid the management activities for the mentioned cons and help lead a sustainable future ahead.Thereby, the farmers and their livelihood are affected by this enormous adverse scenario. The impact of flood in agricultural lands dominates the life span of residents in the study area. Thus, the following recommendations will help mitigate the potential effects and will help to decrease the effects caused by the flood.

A systemic policy implication is critical for preventing potential flood and drought crises by measuring catastrophe risk. Therefore, the government or the state government can implement these policies in the flood-prone areas like the policies that are proposed according to the finding in the study area- Mawadippalli such as highest priority for flood control programs, adjust the cultivation calendar for rainy year prediction, change crop form for dry year prediction, dam storage should be expanded to accommodate potential floods, pre-released water should be used successfully in future conditions, and rainfall and discharge measurement gauges should be installed. State government and Government should allocate agricultural insurance for farmers. In crop and land production, there should be an early estimation of yield, and crop loss is essential, for example, Crop insurance, Promotion and distribution of marketing and delivery planning in advance, Harvest and storage need in preparation, budgeting for the cash balance. Young plants like 20-30-day plants can grow back in the field after the field dry out, and these young plants may help bring air back into the soil. The government of Sri Lanka must take some steps forwards to create climate-resilient varieties of crops and inquire about creating newer flood-tolerant assortments, for example, rice varieties like Swarna-sub1, MTU-1010, and MTU-1140. The Nitrate based fertilizers are ammonium-based, and the potassium nitrate assists the saturated soils to alleviate. Hence, the problems caused by manure usage can be recovered within two weeks. Cleanly maintain the canals to avoid the weed spreading through the irrigation by canals. Maintain a clean environment, for instance, using non- weed organic or compost fertilizers in the field and using non-weed paddy seeds in the fields; thus, this measure enhances weed control in the fields. Controlling diseases via using noninfectious seeds in the fields, even distribution of fertilizers, remove sinistrad plants, plant decreases resistance seeds like BG 305, BG 351, BG352, BG 97-2 etc., sow the seeds at the same time, fire the field when the infection is high and drain the water from the fields, use more pesticides when the impact is immense.

Acknowledgement

I sincerely thank my mentors, Professor, Dr. M. I. M. Kaleel, Department of Geography, SEUSL, and Lecturer, Mr. S. Mathanraj, Department of Geography, EUSL, for urging me to step forward in search ofgetting a respectful higher position in education and profession. Either, the researcher expresses her heartfelt gratitude to all the reviewers as well.

REFERENCES

1. Brémond, P., Grelot, F. & A-L. Agenais. "Economic evaluation of flood damage to agriculture–review and analysis of existing methods." *Natural Hazards and Earth System Sciences*, *13*(10), 2493-2512.
2. Walsh, B. J., & Hallegatte, S. (2019). Socioeconomic Resilience in Sri Lanka: Natural Disaster Poverty and Wellbeing Impact Assessment. *World Bank policy research working paper*, (9015).
3. Chandrasekara, S. S. K., Uranchimeg, S., Kwon, H. H., & Lee, S. O. (2018). Coastal flood disaster in Sri Lanka-May 2017: exploring distributional changes in rainfall and their impacts on flood risk. *Journal of Coastal Research*, (85 (10085)), 1476-1480.
4. Asada, H., & Matsumoto, J. (2009). Effects of rainfall variation on rice production in the Ganges-Brahmaputra Basin. *Climate Research*, *38*(3), 249-260.
5. Hazran, Z., Norsida, M., Nitty Hirawaty, K., & Nolila, M. N. (2017). The post-flood impacts on farmers, agricultural sector and food security in Kelantan. *International Journal of Academic Research in Business and Social Sciences*, *7*(9), 175-184.
6. Jasmine Ara. (2019). Effects of floods on farmer's livelihood: A case study for building agriculture resilient to floods in Bangladesh. *International Journal of Science, Environment ISSN* 2278-3687 (O) 2277-663X (P). Retrieved from: http://www.ijset.net/journal/2327.pdf
7. Rajendran, K., & Achchuthan, S. (2014). Marketing Challenges in Dairy and Paddy sector Development. Individual Farmers Perspective: Evidence from Sri Lanka. *Kajananthan, R., & Achchuthan, S.(2013). Marketing Challenges in Dairy and Paddy sector Development. Individual Farmers Perspective: Evidence from Sri Lanka. Journal of Economics and Sustainable Development*, *4*(1), 150-157.

***Corresponding Author:** M. N. Nuska Banu

8. Kaleel, M. I. M. (2018). Rainfall variability of South-west monsoon: a special study based on Ratnapura District, Sri Lanka. *World News of Natural Sciences*, *18*(2).
9. Snoussi, M., Ouchani, T., & Niazi, S. (2008). Vulnerability assessment of the impact of sea-level rise and flooding on the Moroccan coast: The case of the Mediterranean eastern zone. *Estuarine, Coastal and Shelf Science*, *77*(2), 206-213.
10. *World Scientific News* (n.d.)The influence of rainfall variability in paddy production: A case study in Baticaloa district. *WSN* 52.
11. Mathanraj, S., & Kaleel, M. I. M. (2017). Rainfall Variability in the wet-dry seasons. An analysis in Batticaloa District, Sri Lanka. *World News of Natural Sciences*, *9*, 71-78.
12. Razmy, A. M., & Ahmed, A. N. (2005). Trends in Paddy Production in Sri Lanka. *Journal of Management*, 26-33.
13. Nquot, I., & Kulatunga, U. (2014). Flood mitigation measures in the United Kingdom. *Procedia Economics and Finance*, *18*, 81-87.
14. Sandika, A. L., & Dushani, S. N. (2011). Growth performance of rice sector: the present scenario in Sri Lanka. *Tropical Agricultural Research and Extension*, *12*(2).
15. Lebbe, S. A. (2010). Trends of paddy sector in Ampara district. *Journal of Kalam*. Retrieved from: http://www.researchgate.net/publication/281232719 TRENDS OF PADDY SECTOR IN AMPARA DISTRICT
16. Saqib, S. E., Ahmad, M. M., Panezai, S., & Rana, I. A. (2016). An empirical assessment of farmers' risk attitudes in flood-prone areas of Pakistan. *International Journal of Disaster Risk Reduction*, *18*, 107-114.
17. Ono, S. I. (1991). Effects of flooding and liming on the promotion of mineralization of soil organic nitrogen. *Soil Science and Plant Nutrition*, *37*(3), 427-433.
18. Thiruchelvam, S. (2005). Efficiency of rice production and issues relating to cost of production in the districts of Anuradhapura and Polonnaruwa. *Journal of the National Science Foundation of Sri Lanka*, *33*(4).
19. Indrakularasa, T. (2018). Floods in Northern Sri Lanka endanger paddy farmers' harvest. *Global Press Journal*. Retrieved from: http://globalpressjournal.com/asia/srilanka/came-rains-floods-northern-srilanka-endanger-pady-farmers-harvest/
20. Amarasinghe, U., Amarnath, G., Alahacoon, N., & Ghosh, S. (2020). How Do Floods and Drought Impact Economic Growth and Human Development at the Sub-National Level in India?. *Climate*, *8*(11), 123.
21. Adhikarinayake, T.B. (2005). *Methodical design process to improve income of paddy farmers in Sri Lanka* (*Thesis, Wageningen University*). Retrieved from: http://edepot.wur.nl/121624.
22. Erica Perming. (2013). *Paddy and banana cultivation in Sri Lanka- A study analysing the farmers' constraints in agriculture with focus on Sooriyawewa D.S. Division* (Bachelor thesis, Lund University). Retrieved from: http://core.ac.uk/download/pdf/289945035.pdf.

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