

Roles and responsibilities of stakeholders involved in local-level flood risk management: a study in the Deduru Oya basin in Sri Lanka

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Abstract

Purpose – Disasters are occurring worldwide, and Sri Lanka has also become a victim of multiple disasters. Though there is a disaster management mechanism from the national level to the local level in Sri Lanka, several gaps are identified in pre- and postdisaster management activities. Among them, the responsibilities of local-level stakeholders in flood management activities are not performing at a satisfactory level. Therefore, the flood damage from the previous events was too great. Accordingly, the purpose of this study is to assess the roles, responsibilities and performance of stakeholders involved in local-level flood risk management activities.

Design/methodology/approach – The Deduru Oya basin in Sri Lanka was selected as the study area. The study hypothesized that “ineffective roles, responsibilities and performance of local level stakeholders have weakened the flood risk management in the Deduru Oya basin.” The stratified random sampling method selected the sample ($n = 425$) from the flood-vulnerable population. Primary data were collected through a questionnaire survey, key informant interviews and field observations. Secondary data were collected from reports, work plans, journal papers and published maps. Descriptive data analysis methods and thematic data analysis methods were used in the study.

Findings – About 69% of the respondents state that they are not satisfied with the involvement of government agencies in local-level flood risk management activities, while 10% of the respondents state that they are satisfied. The thematic analysis reveals several gaps, such as the lack of reservations in the Deduru Oya, improper land use practices, no inundation areas are identified and mapped out and the effects of illegal sand mining in the Deduru Oya. In addition to that, the lack of legal power vested in local governments in disaster management and the weaknesses of current legislation on flood risk management are the other major courses of local-level ineffectiveness.



Research limitations/implications – The current research was limited to studying the involvement of local-level stakeholders in flood risk management, but the involvement of subnational and national-level stakeholders should be studied in future research.

Originality/value – This paper examines the involvement of local-level stakeholders in flood risk management. The results of the study confirm that the roles and responsibilities of local-level stakeholders are not well-defined and mandated, and therefore, the performance of stakeholders involved is minimal. Therefore, the results highlight the need for a well-established community-based flood risk management mechanism.

Keywords Flood, Local-level stakeholders, Community-based flood management, Deduru Oya, River basin, Sri Lanka

Paper type Research paper

1. Introduction

The Tsunami disaster, which affected Sri Lanka on 24th December 2004, opened the eyes of the nation, emphasizing that the country is vulnerable to natural disasters. Consequently, the Government of Sri Lanka initiated a new disaster management mechanism in the country by enacting the Sri Lanka Disaster Management Act No. 13 of 2005 (Government of Sri Lanka, 2005). At present, there is a disaster management mechanism operating from the national level to the local level. This system is mainly coordinated by the Disaster Management Centre (DMC) through different stakeholders (DMC, 2017, 2023). The National Council for Disaster Management [1] (NCDM) is the top-level body of this mechanism, the Grama Niladhari [2] (Grama Niladhari Divisional Level Disaster Management Committee) represents the bottom line of the mechanism. In this study, the researcher focuses only on the local-level flood risk management activities of the Deduru Oya basin. Accordingly, the flood risk management mechanism from the Divisional Secretary Division (DSD) level to the village level was considered as the local level mechanism. The roles, responsibilities and performances of the stakeholders of Divisional Disaster Management Committees (DDMC) and Grama Niladhari Divisional Disaster Management Committees (GNDC) were examined. Although the Local Authority Disaster Management Committee and Village Disaster Management Committee have been mentioned in the National Disaster Management Plan (NDMP) of Sri Lanka (DMC, 2014, 2023), they are not operating in the study area.

According to the Global Climate Risk Index 2019, Sri Lanka has been ranked second in the world (Eckstein *et al.*, 2019). As stated in the Status Report of Disaster Risk Reduction (DRR) in Sri Lanka 2019, the country is routinely affected by disasters as a result of climate change (UNDRR and ADPC, 2019). Accordingly, floods have contributed to the major part of disaster damage in the country. The National Policy on Disaster Management of Sri Lanka also states that disaster management authorities should promote DRR-related research in universities, and the universities should implement programs to enhance the capacities of the professionals in disaster risk management (DMC, 2010).

The Sendai Framework for Disaster Risk Reduction 2015–2030 (SFA), as well as the Hyogo Framework for Action 2005–2015, state that disaster risk management should be done with a strong mechanism operating from the national to the local level by the governments (UNISDR, 2015, 2005 [3]). The Government of Sri Lanka, as a member country to implement the SFA, is responsible for adhering to the SFA guidelines.

A flood means a temporary inundation of land. However, if land that is usually above water is gone underwater for hours/days, it is called flooding (DMC, 2020b; NIE, 2008). Concerning the flood disaster, the risk for any region is a product of both the region's exposure and the vulnerability of objects to the hazard. It means that the three main factors; hazard, exposure and vulnerability contribute to a region's flood disaster risk Hori *et al.*, 2002 cited in Thywissen (2006).

The Deduru Oya has been well-known for its flash floods since in the past (Karunathilaka, 1989; Manchanayake and Madduma Bandara, 1999). As per the JICA (2017), there are 84,000 population in flood-vulnerable areas in the Deduru Oya basin, which is the fifth largest number of flood-vulnerable population in a river basin in Sri Lanka. Further, there are many flood records in the Deduru Oya basin in recent years and the details of them are mentioned in Table 1.

Table 1 shows the flood-affected population in 20 DSD in Kurunegala and Puttalam districts. Accordingly, Chilaw (71,664), Arachchikattuewa (50,974), Bingiriya (9,253) and Pallama (5,887) DSDs appear to be more prone to floods comprising 83% of the affected population in the area.

Bollin *et al.* (2003) state that in a decentralized system, the local actors can play a major role more effectively in DRR. Some of the important recommendations are:

- Local governments should be supported to introduce risk management into local development activities under their jurisdiction.
- The capacity of the local governments should be developed and it is desirable to establish a branch to specialize in risk management. Accordingly, local funds should be created for risk management. The establishment of formal responsibilities for all the local, departmental and national level institutions is required.
- Countries should formally create decentralized national systems via localities to identify, mitigate, transfer risk and do preparedness, response and postdisaster reconstruction activities.
- The local governments should be allowed to assume responsibilities of risk management with the human, scientific, technical and financial support of the rest of the government.

DSD	2010	2011	2012	2014	2015	2016	2018	2019	Total
Chilaw	4,862	0	33,856	11,586	4,126	9,577	4,230	7,657	71,664
Arachchikattuwa	1,629	0	25,802	8,543	2,178	11,317	1,505	0	50,974
Bingiriya	1,525	0	3,582	2,543	0	1,603	1,722	765	9,253
Pallama	488	0	1,390	1,740	8	1,086	1,115	60	5,887
Paduwasnuwara West	819	0	1,867	191	0	652	889	0	3,529
Kurunegala	0	0	1,269	688	317	605	281	0	2,879
Wariyapola	0	345	1,476	764	0	281	10	92	2,866
Kobeigane	480	420	907	0	0	829	12	40	2,636
Rasnayakapura	396	360	532	571	0	409	539	374	2,268
Mawathagama	0	0	790	1,117	0	87	0	0	1,994
Ibbagamuwa	0	0	590	1,066	189	36	0	0	1,881
Ridigama	0	0	752	1,128	0	0	49	0	1,880
Mallawapitiya	71	37	1,528	13	75	0	14	0	1,724
Bamunakotuwa	151	148	976	148	0	149	320	0	1,572
Nikaweratiya	0	0	506	470	0	340	44	235	1,316
Maspotha	79	245	730	0	0	51	36	0	1,105
Ganewatta	57	28	697	0	0	236	0	0	1,018
Paduwasnuwara East	84	0	431	0	0	34	249	0	549
Maho	0	0	395	0	0	0	0	146	395
Wirambugedara	18	0	202	0	0	50	34	0	270
Total	10,659	1,583	78,278	30,568	6,893	27,342	2,620	7,717	165,660

Table 1.
Population affected
by floods in 20 DSDs
in the Deduru Oya
basin, 2010–2019

Source: Prepared by researcher based on the data from Divisional Secretariat (2020a, 2020b, 2020c, 2020d), DDMCU (2020e, 2020f) and DMC (2020a, 2020b)

- It is imperative to involve a wide range of local actors from the public sector, private sector and the community for comprehensive disaster risk management.
- Because the local governments have several sources of revenue, such as fees, taxes, transfers from the national government and loans they can be involved in DRR activities.

Carter (2008) has argued that the roles and responsibilities should be clearly defined and vested to the relevant organizations, enabling them to efficiently perform in disaster management. Evers *et al.* (2012) identify the importance of active involvement of stakeholders in urban flood management through a study done in Germany. According to Azad *et al.* (2019), a community-based disaster management mechanism in Bangladesh is studied where the community and the other stakeholders engage in disaster risk management activities.

A case study of OXFAM (2013) reveals that DRR in Sri Lanka was still very much a top-down approach where government agencies decide what kind of disaster mitigation initiatives are required for flood hazards. Through a case study in Sri Lanka, Malalgoda *et al.* (2013) reveal that though the local government is a main stakeholder in local-level disaster management, they are facing some problems that obstruct them from preparing the cities resilient for disasters.

According to the NDMP, the stakeholders engaged in disaster management activities from the national to the local level are government ministries, departments, agencies, district secretariats, divisional secretariats, Grama Niladharies, media, UN Agencies, Sri Lanka Red Cross, NGOs, INGOs, CBOs, vulnerable communities, volunteers and the private sector agencies. (DMC, 2014, 2023).

The Community Resilience Framework (CRF) of Sri Lanka has been developed to guide and facilitate the local authorities (Divisional Secretariats and Local Authorities [4]) and the DMC to build the resilience of local communities. The CRF states that community representatives should participate in risk assessment, while the risk assessment process is led by the Las. Also, the community-based approach is a tool for DRR that can be identified as a bottom-up participatory and development approach (DMC, 2015).

According to the Puttalam and Kurunegala Districts' Disaster Response Plans, District Secretaries and their staff, District Disaster Management Coordinating Units (DDMCU) staff, Divisional Secretaries and their staff, Grama Niladharies, Development Officers, district and divisional level government agencies including Police, Army, Navy, Air force, Health Department, Irrigation Department (ID), Agrarian Development Department, Agriculture Department, Local Authorities, Ceylon Electricity Board, National Water Supply & Drainage Board, Road Development Authority, Provincial Road Development Authority, Fire Fighting Units, Religious Leaders, Private Sector, NGOs, CBOs, Community, etc., can be identified as the stakeholders and some of them are included to committees or subcommittees from the district, divisional to GN level (DMC, 2018a, 2018b). The District Disaster Management Committee, Divisional Disaster Management Committee and GN Level Disaster Management Committee are mentioned as the mechanisms at each level.

The Government of Sri Lanka is responsible for implementing the SFA. The SFA states that the governments have the overall responsibility for DRR while the responsibilities are shared with the other relevant stakeholders.

According to JICA (2009, 2013, 2017), there were no agencies responsible for each disaster in Sri Lanka up to the 2004 Tsunami. At that time, there was no disaster risk management (DRM) legal framework or an overall coordinating mechanism. Consequently, the Sri Lankan Government enacted the Sri Lanka Disaster Management Act, No.13 of 2005, specifying the comprehensive DRM framework. The act aimed to establish a DRM organizational structure and to shift away from the emergency response to preparedness.

However, [JICA \(2017\)](#) identify some inconsistencies with the present requirements and the Sri Lanka Disaster Management Act, No.13 of 2005. Also, some related laws of disaster management in Sri Lanka are either in the creation or in the amendment process. The National Building Research Institute Act is in the process of a new establishment. Flood Act is in the process of new establishment as an amendment to the existing Flood Ordinance of 1924/1955 and the Sri Lanka Land Reclamation and Development Corporation Act of 2006 is in the process of amendment. Further, the [JICA \(2017\)](#) states that the DRR functions at the local level are operating under the two administration systems parallelly: one is the “National Administration Line” and the other is the “Local Administration Line.” Both lines function independently with separate personnel and budget allocations. However, there is no permanent mechanism to coordinate both lines and the lines are coordinated through temporary meetings as necessary.

Additionally, the [JICA \(2017\)](#) has revealed that the ID which was established in 1900, is presently functioning as the mandated agency for flood management under the legal provisions of the Flood Ordinance No. 22 of 1924/1955 ([Government of Sri Lanka, 1924](#)). The ID has the responsibility for flood control, issuing flood early warnings and implementing structural mitigation measures. The JICA reveals that the sharing of roles and responsibilities of flood management among relevant agencies is not clearly described in the Flood Ordinance. Although the ID is responsible for structural mitigation measures, ID is not mandatory for nonstructural measures. The [JICA \(2017\)](#) also states that the existing land use plans have not addressed the flood hazard adequately. Further, the JICA report has identified that there are malfunctions in the agencies that are working on DRR-related activities. There are shortcomings in the process of disaster information and data collection from the divisional and district level to the national level. In the process of reporting the impacts of disasters, only the information regarding the affected population and damaged houses are reported up to now; no other damage information that is very important in decision-making is available.

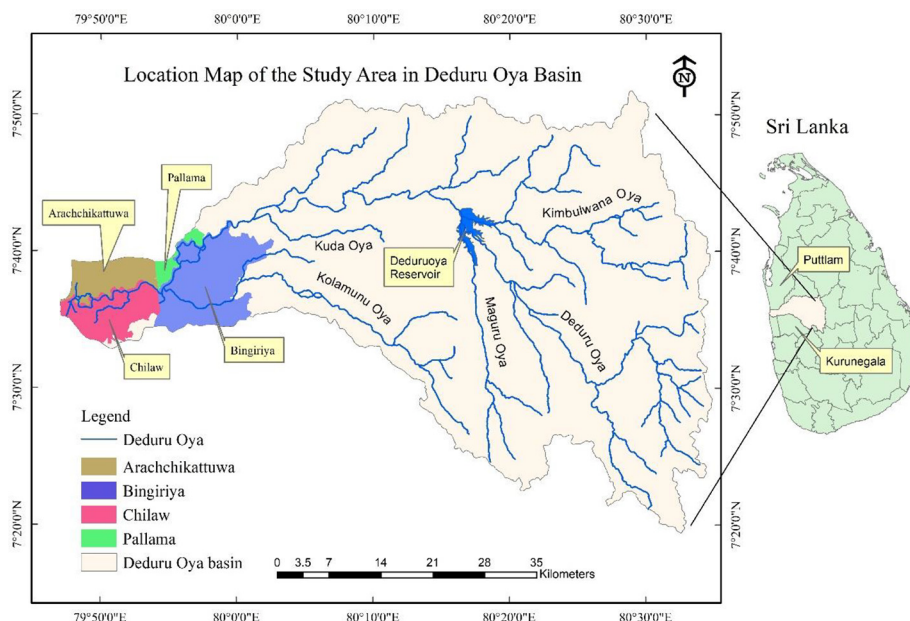
Several rivers like Kelani, Kalu, Nilwala and Gin in Sri Lanka are famous for regular floods and some studies on flood management of those rivers have been done ([JICA, 2009, 2013, 2017](#)). Likewise, floods occurred in the river basins of Deduru Oya, Maha Oya, Attanagalu Oya and Malwathu Oya, etc., in the past and those floods have caused considerable impacts on communities ([DMC, 2020a](#)), but very limited studies have been done on them. However, no comprehensive study has been done on flood risk and flood management in the Deduru Oya basin, though the Deduru Oya is well known for flash floods.

The objective of this study is to assess the roles, responsibilities and performance of stakeholders engaged in local-level flood risk management activities in the Deduru Oya basin. Accordingly, the hypothesis of “ineffective roles, responsibilities and performance of local level stakeholders have weakened the flood risk management in the Deduru Oya basin” was tested in this study.

2. Materials and methods

2.1 Study area

The Deduru Oya basin is the core study area, which is the fourth-longest river in Sri Lanka. It runs about 115 km from the headwater in the Hedeniya area in Kandy district and discharges its water into the sea at Chilaw in Puttalam District ([Jayasena and Kulasekara, 2015](#)). As well the Deduru Oya basin is the fifth largest river basin in Sri Lanka ([Centre for Environmental Studies, 2002](#)). The land extent of the Deduru Oya basin is 2,616 km² ([Katupotha, 2015](#)). Several streams contribute to the discharge of the Deduru Oya, i.e. *Maguru Oya*, *Kimbulwana Oya*, *Kuda Oya* and *Kolamunu Oya* ([Figure 1](#)). The Deduru Oya



Source: Developed by the researcher using the data from the Survey Department of Sri Lanka and the data from the Department of Geography, University of Peradeniya, based on Wanninayake *et al.* (2023)

Figure 1.
Location map of the
study area

basin contains 3,274 irrigation tanks (small- and medium-scale tanks) in its extent, showing the highest density of irrigation tanks in a river basin in Sri Lanka (Centre for Environmental Studies, 2002).

Out of the 35 DSDs that represent the whole river basin to different extents, the most flood-vulnerable four (04) DSDs were selected purposely as the core study area considering their high flood vulnerability (see Table 1). The selected four DSDs are Chilaw, Arachchikattuwa, Pallama and Bingiriya, which are located at the lowest part of the basin.

2.2 Sampling method

The stratified random sampling method was used in the current study to select the sample from the flood-vulnerable population. The list of families residing in flooding areas of the selected GNDs was prepared by the researcher (sample frame $n = 2,830$) based on the information collected from the relevant *Grama Niladharies*. Then, using the random sampling method, 425 families ($n = 425$), about 15% of the population were selected for data collection.

2.3 Data collection

Several methods were used to collect primary data, i.e. a questionnaire survey, key persons' interviews and field observations. A questionnaire survey was conducted among the sample. Key persons' interviews were conducted with the stakeholders and the community leaders to collect the data. Stakeholders engaged in local-level flood risk management activities, namely,

the Divisional Secretaries/Assistant Divisional Secretaries of Chilaw, Arachchikattuwa, Pallama and Bingiriya DSDs, Grama Niladharies/Development Officers of selected 15 GNDs, Commissioner for Local Governance of North Western Province, Irrigation Engineers for Puttalam and Kurunegala districts, Representatives from the Local Governments (Pradeshiya Sabhas) of Chilaw, Arachchikattuwa, Anamaduwa and Bingiriya, Assistant Directors of DMC for Puttalam and Kurunegala districts, Assistant Directors of Land Use Policy Planning Department (LUPPD) for Puttalam and Kurunegala districts, Executive Officers of Sri Lanka Red Cross Society for Kurunegala and Puttalam districts and village level community leaders were interviewed. Field observations were done by the researcher to verify some flood preparedness measures in the area. The secondary data were collected from reports, work plans, journal articles and published maps.

2.4 Data analysis

Qualitative data analysis methods were used to analyze the data. Thematic Data Analysis method was used to analyze the interview data. [Braun and Clarke \(2006\)](#) and [Kiger and Varpio \(2020\)](#) have identified that thematic analysis is better for interviewed data analysis.

The main limitation of the study was the dearth of published papers/books/reports on flood risk and flood risk management in the Deduru Oya basin.

3. Results and discussions

3.1 Identification of local-level stakeholders through policy documents

The local-level stakeholders engaged in flood risk management activities were identified based on two policy documents, i.e. the NDMP ([DMC, 2014](#)), and the Divisional Disaster Response Plans (DDRP) of relevant DSDs. These sources state the composition of DDMC and GNDC.

According to the NDMP, the composition of the GNDC is: *Grama Niladhari* is the Chairman of the committee and the other members include the community leaders, NGOs, a school teacher, a businessman in the area, any officials, professionals, skilled workmen, mechanics, ex-servicemen and others necessary. As the advisors to the GNDC, the chief priest of the temple/church/mosque, the school principal and the *Veda Mahaththaya* [\[5\]](#) (village Ayurveda doctor) are named. Further, the GNDC is cited as it consists of the following subcommittees: Early Warning Committee, Search and Rescue Committee, First Aid Committee, Camp Management Committee and Security Committee. Although the NDMP has stated such a composition of GNDC, really such committees are not operating in the field. As per the respondents, the main reasons for not performing such committees are that the stakeholders have no clear understanding of the functions of the committee, no legal mandate for the committee, there are no legally assigned roles and responsibilities for the stakeholders, there is no work plan and budget, and the villagers are already embarrassed with a lot of committees at local level.

According to the DDRPs of Arachchikattuwa, Bingiriya, Chilaw and Pallama ([DDMCU, 2020a, 2020b, 2020c, 2020d](#)), the DDMC comprises the following Officers/Institutions and other organizations; the Divisional Secretary (DS) (Chairman), Assistant Divisional Secretary, Grama Niladharies, Development Officers and the head or representative of the divisional level offices of the departments of Police, Education, Agrarian Development, Coast Conservation, Wildlife Conservation and the LA. Also, the leading Community-Based Organizations, Youth Service Centres, Public Inspectors of Health and Clergy are included in the committee. The DDRP also mentions that the DDMC operates in five subcommittees that have responsibilities for various activities. The National Emergency Operation Plan of Sri Lanka (NEOP) also states on the DDMC ([DMC, 2017](#)). Accordingly, the DS can be recognized

as the main coordinating authority in flood disaster management at the local level. He has the responsibility of coordinating other institutions in various activities of flood risk reduction. As [Malalgoda et al. \(2013\)](#) and the [DMC \(2015\)](#) mention, the LAs (Pradeshiya Sabha/Urban Council/Municipal Council) have a significant role in disaster management at the local level.

3.2 Identification of local-level stakeholders through the people's perception

The researcher conducted interviews with key persons ($n = 32$) at the local level to identify the stakeholders engaged in flood risk management activities. According to the respondents, the following officers were identified as being involved in local-level flood management activities: DS, Disaster Relief Service Officers, *Grama Niladharis*, Officers of DDMCU, Irrigation Engineers, Police Officers, Medical Officers of Health and LAs.

Further, the researcher identified the stakeholders engaged in local-level flood management activities through the perception of the people. Data were collected for this analysis through a questionnaire survey ($n = 425$). As per the people's responses, the following stakeholders are engaged in local-level flood management activities. The percentages of responses are mentioned in brackets. The stakeholders, from the Buddhist Monks to the ID of the below list, have received less than 1% of the responses.

- Grama Niladhari (61.4%)
- Divisional Secretariat (10.8%)
- Economic Development Officer (6.4%)
- Samurdhi Officer [\[6\]](#) (3.1%)
- Political Authority (2.6)
- DMC/Disaster Relief Officers (2.4%)
- Police (1.8%)
- Buddhist Monks
- Agricultural Research Production Assistants
- Donors
- Public Health Inspector (PHI)/Health Sector
- Red Cross
- CBO Members
- Catholic Monks
- Local Authority
- Army
- Department of Agrarian Development
- Irrigation Department (ID)

Accordingly, 61% of the respondents mentioned that Grama Niladhari is involved in village-level flood management activities and 10% of respondents state that the DS and his staff are involved in flood management activities. However, 6% of the respondents stated that no government officer or institution engages in any flood management activity. Respondents identify 18 stakeholders as being engaged in village-level flood risk management activities though their contribution is at different levels. This result is good evidence to show the lack of coordination of the stakeholders with the community in the area. The involvement of

Grama Niladhari in the flood management activities in GND has been confirmed by only 61% of the respondents, while 39% of the respondents have stated that even Grama Niladhari is not involved in the flood management activities in the area.

As mentioned in above Section 3.1, though many stakeholders are mentioned as being engaged in local-level disaster risk management activities based on some policy documents, Section 3.2 gives evidence that only a few institutions are engaged in local-level flood risk management activities in real situations.

3.3 *Examine the roles and responsibilities of local-level stakeholders*

The roles and responsibilities of stakeholders are mentioned in NDMP and the DDRPs of Arachchikattuwa, Bingiriya, Chilaw and Pallama DSDs (DMC, 2014; DDMCU, 2020a, 2020b, 2020c, 2020d). According to the NDMP, the responsibility to identify disaster mitigation projects and prepare mitigation plans goes to the Provincial Councils (PC), LAs, and all public and private sector organizations (DMC, 2014). Also, the district, divisional and GN-level administration need to develop disaster mitigation plans and they also need to coordinate with the line agencies to develop mitigation plans. Rather, the LA has the right by law to control the haphazard development activities in respective areas that can generate any type of disaster. Although the NDMP has stated the responsibility to prepare disaster management plans by various agencies, there are no disaster mitigation plans prepared so far by the local-level institutions in the study area. The PC and LAs are not empowered by law to perform disaster risk management activities; therefore, those institutions have not actively engaged in flood management activities. According to the respondents, disaster management plans/flood management plans have not been prepared by other agencies except for the district and divisional preparedness plans by the DMC, but those plans have addressed only the response phase.

The NDMP has cited the principal agencies that are responsible for hazard mapping, information and risk assessment, etc. In the current study on flood risk management in the Deduru Oya basin, the ID was identified as a responsible agency for establishing a database of flood information, identification of flood patterns, mapping the flood inundation areas, modeling flood simulations, monitoring reservoir water levels, operations of spilling gates of reservoirs, sudden floodwater releases from the reservoirs, issuing flood early warnings and maintaining the dam safety of reservoirs, etc. The Department of Meteorology is responsible for forecasting rainfall and adverse weather conditions. The LUPPD has the responsibility of preparing a general land use plan at the district level. The DMC has the responsibility of doing a general vulnerability and risk assessment to identify and grade the different areas as high, medium or low-risk areas. A location-specific vulnerability and risk assessment should be done by the relevant sectors before implementing new development projects. However, as per the stakeholders, local-level flood hazard maps have not been prepared and comprehensive flood risk assessments have not been done for the community level, but the operation of spill gates of the Deduru Oya reservoir to release excess water on flood occasions and issuing the flood early warnings are presently practicing.

The roles and responsibilities of the stakeholders engaged in local-level flood risk management activities are mentioned in the DDRPs of Arachchikattuwa, Bingiriya, Chilaw and Pallama DSDs. The DDRPs address the activities of preparedness and response phases of the disaster management cycle concept. However, mitigation plans for flood risk management have not been prepared for the study area.

By the DDRPs, the roles and responsibilities of the stakeholders are mentioned under subcommittees:

- Early warning dissemination subcommittee;

- Evacuation, search and rescue subcommittee;
- Relief camps, food and security subcommittee;
- Immediate restoration of services, rehabilitation and reconstruction subcommittee; and
- Health and welfare subcommittee.

According to the respondents, there is a flood early warning dissemination system presently operating in the area. Though most people receive flood early warnings through this system, some people do not receive flood early warning messages. About 84.5% of the respondents stated that there is a flood early warning dissemination system in the area, while 15.3% of the respondents stated that there is no flood early warning dissemination system. However, the community has asserted the requirement for a new system that can send early warnings to all families forthwith. Even though the responsibilities have been reported for the evacuation, search and rescue subcommittee, such an organized committee is not functioning in the study area. About 86.6% of the respondents affirmed that no training and awareness program or evacuation drill has been conducted in their villages, while 13.4% of the respondents stated that only one training and awareness program has been conducted in their GNDs.

As per the respondents, there are not even the essential facilities in some temporary camps to which the people evacuate during the floods. Nevertheless, respondents pointed out that some temporary camps are inundated on high flood occasions, and in some areas, there are no evacuation centers and the people are evacuated into temporary huts constructed on roads. Furthermore, such organized subcommittees are not existing in the study area.

As per the responses on the immediate restoration of services, rehabilitation and reconstruction subcommittee, some of the activities are performed by the relevant agencies and those activities are coordinated by the DS. But, an unnecessarily long time is taken for some rehabilitation work. However, damage assessments have not been done for every aspect affected by floods, in most cases, the damage assessments have been done only for houses.

According to the respondents, an organized subcommittee on health and welfare is not operating in the study area, but the Medical Officer of Health/Public Health Inspector inquired about the requirement of sanitary measures in temporary camps during flood occasions and mediate to control spreading epidemics. However, necessary training and awareness programs have not been conducted.

Even though the DDRPs have illustrated the roles and responsibilities of the stakeholders, the DDRPs are not implemented in the study area. The reasons for not implementing DDRPs are:

- These DDRPs have been prepared by the respective DDMCUs, but not through the proper involvement of other stakeholders.
- The DDRPs have no legal mandate to be implemented by the relevant stakeholders, and also, the funds have not been allocated to implement the DDRPs.
- The stakeholders and the community have not been well aware of the DDRPs and their inputs have not been included in these plans.

3.4 Effectiveness of the roles and responsibilities of local-level stakeholders

The satisfaction of the people with the involvement of responsible government agencies in flood risk management activities at the community level was studied (Figure 2).

As per [Figure 2](#), about 17% of the respondents insisted that they are strongly not satisfied and 52% of the respondents stated that they are not satisfied. Only 10% of the respondents stated that they were satisfied. Altogether, 69% of the respondents are not satisfied with the stakeholders' contributions to local-level flood risk management. This result confirms that the performance of stakeholders engaged in local-level flood management is minimal.

The researcher conducted interviews with the key persons among stakeholders engaged in local-level flood risk management activities to identify the effectiveness of the roles and responsibilities of stakeholders. The key persons interviewed ($n = 32$) are mentioned in [Section 2.3](#). According to the findings of thematic data analysis, the following results were obtained:

- Nonexistence of reservations to the Deduru Oya

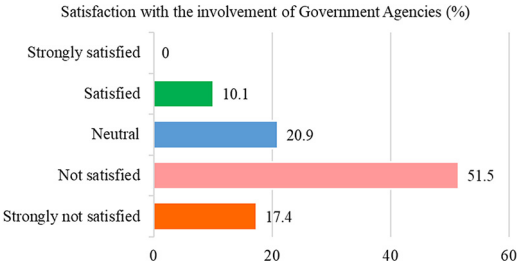
Reservations to the river are not demarcated and protected by the authorities even though legal provisions exist to protect rivers/streams. According to the Circular No.08/2014 of the Irrigation Department of 2014 and, the Land Manual of Sri Lanka ([Department of Land Commissioner, 1985](#)), if the width of the river bed is more than 15 m, the reservation area should be 60 m for each bank measured from the bank. However, the reservations of the Deduru Oya are not demarcated and protected, most of the lands beside the river in the study area are encroached on by the people. In addition, the wetlands of the lower part of the river are not protected. Therefore, most wetlands are encroached for crop or prawn cultivation:

- Improper land uses

Most of the lands that have been used for house construction, cultivation, animal husbandry and other uses in the study area are state lands. Only a few lands have private ownership with *Sinnakkara* [\[7\]](#) deeds. Some of these state landholders have been given *Swarna Bhumi/Jaya Bhumi* [\[8\]](#) deeds later by the governments. The number of lands under each category of ownership is presented in [Table 2](#).

As per [Table 2](#), only 8.7% of the families have *Sinnakkara* land titles, while 41.9% for *Jayabhumi/Swarnabhumi* titles, 21.9% for permits, 5.2% are in reservation lands and 22.3% of families have occupied crown lands. Overall, 49.4% of the families do not have the right to their occupied lands. These lands in flood inundation areas have been encroached by residents. The state ownership of the majority of lands in the area indicates that these lands had not been recognized as suitable for human use in the past because of their proneness to floods. As per the respondents, the improper uses of land such as house constructions/other

Figure 2.
Community
satisfaction with
government sector
involvement in flood
DRM



Source: By researcher

GND	<i>Jayabhumii/ Sinnakkara Swarnabhumi</i>		Permit	Reservation	Crown land	Permit, reservation, crown lands-Total
Thimilla	167	0	0	0	341	341
Weerakumandaluwa	26	99	53	59	92	205
Wirapadiyana	0	94	101	0	27	128
Deduruoya	0	134	40	80	7	127
Dematapitiya	0	85	92	0	20	111
Bangadeniya	0	47	80	0	7	87
Manuwangama West	0	74	61	0	13	74
Parappanmulla	0	72	33	0	33	66
Mahawilattawa	46	46	13	0	52	65
Nariyagama North	0	41	41	0	7	47
Pallama	0	168	40	0	7	47
Mukkandaluwa	7	81	34	0	0	34
Molaeliya	0	72	20	0	13	33
Elivitiya	0	68	14	0	14	27
Gatulawa	0	107	0	7	0	7
Total	246	1,187	620	146	632	1,398
%	8.7	41.9	21.9	5.2	22.3	49.4

Local-level
flood risk
management

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Table 2.
Ownership of
residential lands in
flood inundation
areas (in number of
families)

Source: Questionnaire survey data by researcher

constructions in flood inundation areas, cultivations/farming in inundation areas, blockage of channels and landfilling, etc., have caused to increase floods. Figure 3 shows the land use changes from 1947 to 2018. The land use map was developed based on a 1 km buffer area to the Deduru Oya in its lower part. Accordingly, the land use pattern in the flood-vulnerable area in the Deduru Oya basin has significantly changed. In “Map 1,” most of the areas behind the river are covered with forests, scrubs and forest reservations. But, in “Map 2,” all those forest lands have been converted to home gardens, coconut cultivations or paddy cultivations. These land use changes have affected triggering floods. According to the questionnaire survey ($n = 425$), 90.4% of the respondents affirmed that no land-use plan or any guideline is implemented in the area:

- Inundation areas have not been identified and mapped out

Flood inundation areas of GNDs have not been identified in the field and mapped out in most of the GNDs. However, preparing inundation area maps incorporating the features of infrastructure facilities, houses, other buildings, industries, cultivating lands, animal husbandry, etc., is important in flood risk management. GND level flood inundation area mapping should be done with the participation of the community:

- Illegal sand mining in the Deduru Oya and its effects

Until the Supreme Court suspended sand mining in the Deduru Oya in 2006 (Supreme Court case number is S.C.F.R.No. 226/06), sand miners had caused irreversible damage to the river. The sand mining was done using heavy machinery inside the river at that time, thereby the river bed was deepened hugely, the banks were eroded and consequently, the river was greatly widened (Figure 4). Most of the dug wells adjacent to the river dried up because the groundwater level had gone down. As of 2020, the saline water has intruded nearly 3 km inland of the river. The intrusion of saline water created many problems, such as pollution of drinking water, degradation of paddy lands and home gardens, etc. Some places of the

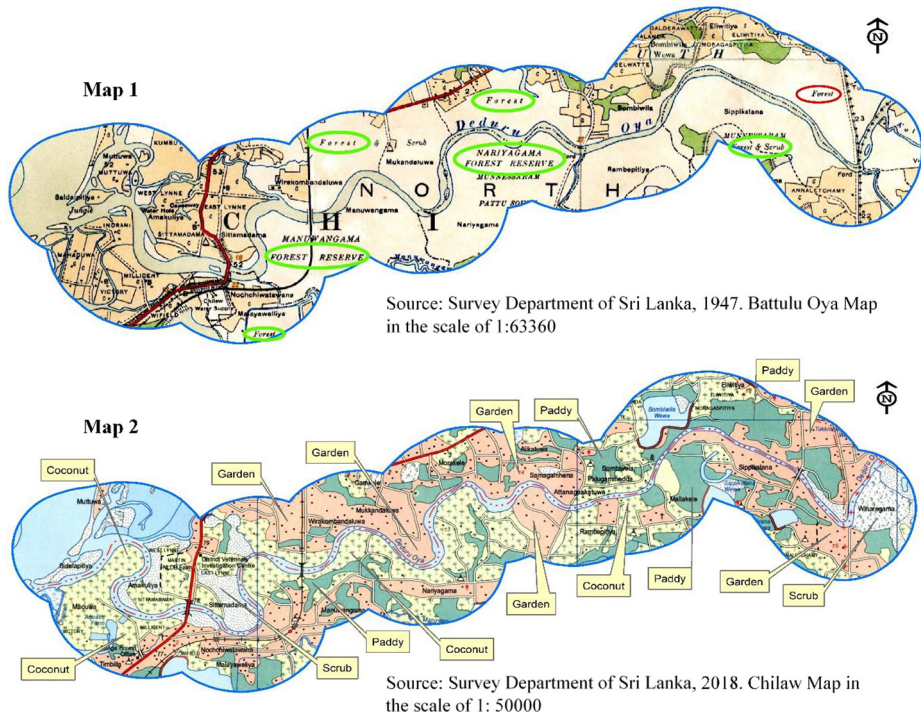


Figure 3.
Land use changes in
flood-vulnerable
areas in Deduru Oya
basin

Source: Prepared by researcher based on the sources mentioned in Map 1 and Map 2



Figure 4.
Deduru Oya at
Nariyagama North
GND; Expansion of
the river

Source: By researcher

riverbank in Manuwangama West and Nariyagama North GNDs have been greatly eroded. All these issues have come up as a result of illegal sand mining in the Deduru Oya:

- Administration and institutional issues of key responsible agencies

Although the DMC implements local-level flood mitigation projects, all those projects are implemented through other institutions, e.g. ID. This has been difficult to identify flood

mitigation projects, proposal development and implementation mitigation projects. DMC carder should be restructured with the necessary technical carder:

- Absence of legal power to local governments in disaster management

The LGs have more resources such as financial capability, machinery, labor, etc., to manage flood disasters. However, their involvement in flood risk management activities in the study area is very limited. The legislative power is not vested to the LGs by any acts such as the Disaster Management Act No.13, 2005 ([Government of Sri Lanka, 2005](#)), Urban Councils Ordinance No.61 of 1939 ([Government of Sri Lanka, 1939](#)), Municipal Councils Ordinance No.29 of 1947 ([Government of Sri Lanka, 1947](#)) and the Pradeshiya Sabha Act No.15 of 1987 ([Government of Sri Lanka, 1987](#)). Accordingly, flood management at the local level is functioned only under the national administration system via DS offices. The LGs have funds to operate in emergencies of floods or any other disasters. Therefore, well-defined responsibilities should be given to the local-level institutions regarding disaster management activities ([Government of Sri Lanka, 2009](#); [Malalgoda et al., 2013](#); [Amaratunga et al., 2018, 2020](#)):

- Weaknesses of prevailing legislation related to flood risk management

The roles and responsibilities of stakeholders engaged in flood risk management have not been specified in the existing flood ordinance ([Government of Sri Lanka, 1924](#)). All the relevant agencies should be mandated with the roles and responsibilities by regulations of flood management. Presently, even the officers of the DDMCUs have no legal power to take judiciary actions against those who create disaster-induced activities. Land use plans for every DSD in Puttalam and Kurunegala districts have been prepared by the LUPPD, but they are not still implemented because the land use plans have no legal mandate to be implemented.

4. Conclusion and recommendations

Most of the above-mentioned evidence has shown that the performance of stakeholders in flood risk management activities in the study area is still ineffective. Nonenforcement of the existing laws, e.g. demarcating the reservations of the rivers, stopping land encroachments, preventing illegal sand mining, etc., can be identified as some of the causes that have contributed to the ineffectiveness. People have encroached on reservations and wetlands, but the authorities have not taken actions to prevent them. The authorities have not demarcated the flooding areas and the areas that should be conserved. Various flood-related problems have been created by illegal sand mining in the river. Administration issues and work duplications among main disaster management agencies have been existing for many years. The local governments have not appropriately engaged in local-level flood management activities because they have not been given legislative power. Accordingly, the following recommendations can be made for better flood risk management:

- Existing flood early warning systems should be developed and a better dissemination system should be applied.
- Awareness and training programs for the local level stakeholders and communities should be made with a long-term plan.
- District, divisional and Grama Niladari level disaster management committees should be reestablished properly, and the respective disaster management plans should be prepared with sufficient involvement of the stakeholders and the community. Also, plans should be given the legal mandate and funds to be

implemented. The responsibility of preparing the DDRPs should be given to the relevant local authorities. DMC should only facilitate and create awareness and give training to the local level stakeholders to prepare the DDRPs.

- Flood hazard maps should be prepared for the whole river basin based on GNDs. According to [Abbas *et al.* \(2016\)](#) flood hazard mapping is already done in Bangladesh, as well as in India, in the Asian region. Moreover, hazard mapping in flood risk management is used as a good tool in many other countries in the world ([Sayers *et al.*, 2013](#)).
- Flood insurance schemes and market-based solutions should be introduced to minimize flood damage.
- There should be an emergency fund or allocation at the district or local level for response and recovery activities of multiple disasters to use in emergencies. Because most of the people living in flood-vulnerable areas are poor, they do not have enough coping capacity or rebuilding capacity for floods or other disasters. [Figure 5](#) shows the houses constructed in flood-vulnerable areas; some of them have been constructed to resist flood water, while some are more vulnerable to floods. Therefore, some loan schemes should be introduced to facilitate the necessary people. As [Twigg \(2004\)](#) mentioned, operating insurance schemes and loan/credit (Microfinance) schemes in disaster-vulnerable areas can assist people in resisting disasters.
- Public participation in flood management, awareness, training programs and village-level meetings is far less, so it should be enhanced. The [WMO \(2017\)](#) and many others affirmed the importance of CBFDRM. Then, a better communication and coordination system for flood risk management activities at the local level can be established.
- Comprehensive flood damage and loss assessments counting the damages to the crops, livestock, houses and buildings, equipment and assets, industries, infrastructures, etc., for previous floods in the Deduru Oya basin have not been done. However, damage



Figure 5.
Houses constructed in
flood-vulnerable
areas in Deduru Oya
basin

Source: By researcher

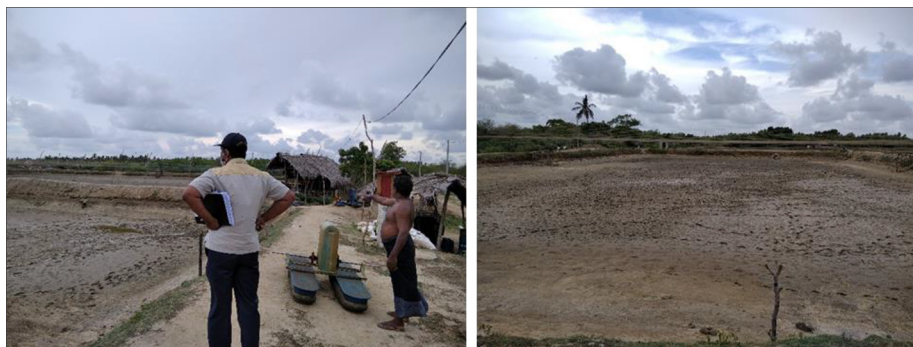


Figure 6.
Prawn cultivation
tanks in
Kumbuttukuliya area
in *Bangadeniya* GND

Source: By researcher

assessments have been done in 2016 and 2017 for flood and landslide disasters in Sri Lanka by the Ministry of Disaster Management with the support of some other agencies (MDM, 2016; MDM, 2017). Comprehensive flood damage assessments are important to every flood event in the area to plan preparedness and mitigation measures.

- Though the overflowing of the river is the main cause of floods in the area, on some occasions, flash floods have occurred in some places as a result of the blockage of water channels/streams. So, those barriers should be removed by the authorities regularly. In addition, several prawn cultivation tanks have been built near the lagoon (Figure 6) and those prawn cultivation tanks have triggered floods in the area by blocking the water flow.
- The Deduru Oya reservoir has controlled creating floods through the gradual and systematic release of excess water on flood occasions. But on some occasions, if an excessive amount of water is accumulated in the reservoir due to excessive rainfall, it will not be able to manage the flood through the reservoir. Therefore, preparedness and mitigation measures should be applied efficiently and effectively.
- When constructing houses in inundation areas, the houses should be constructed elevating the plinth level above the high flood level. The government should introduce necessary guidelines and give financial support to low-income families. Most appropriate land use plans should be prepared and implemented by the authorities, especially for the flood inundation area to minimize floods. Implementation of a bamboo tree plantation project is proposed by the respondents as one option.

Notes

1. NCDM has been established by the Disaster Management Act of Sri Lanka, 2005 as the top-level policy-making body on disaster management in Sri Lanka.
2. Grama Niladhari is the government officer engaged in administrative activities at the community level in Sri Lanka.
3. United Nations International Strategy for Disaster Reduction is one of the major international institutions working for disaster management based in Geneva.
4. Both the DSDs and Pradeshiya Sabhas/Urban Councils/Municipal Councils have been considered as local level.

5. *Veda Mahaththaya* is the Ayurvedic Doctor who gave medicine to the community people in the ancient local societies and presently also in some villages *Veda Mahaththura* is serving.
6. Samurdhi officer is a village-level government officer who engages in activities to enhance the income of low-income families through the Samurdhi Program.
7. *Sinnakkara* deed gives the absolute ownership of land to the occupant.
8. *Jayabhum*i/*Swarnabhum*i deed don't give the absolute ownership to the occupant and the government also has some right. Permit lands, reservations and crown lands belong to the government.

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