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Fostering Collective Action in a Village-Tank Cascade-Based Community in Sri Lanka: An Illusion or Reality?

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Abstract: Collective action has inevitable importance for sustainable governance of shared resource systems with interactions across multiple social and spatial scales. Village irrigation tanks in Sri Lanka have been recognized as shared resource systems sustainably managed through the collective action of local communities throughout history. Increased population pressure on shared resources and expanded socio-economic relationships over time have led to extended resource-based interactions between people. This occurred beyond village tanks within the broader scale of Village-Tank-Cascade Systems (VTCS), in which village tanks are constituent sub-units. This demands the cross-scale collective action of local communities for sustainable governance of VTCS, which has become a challenging endeavor in the current context. This case study explores the dynamics of collective action across multiple social and spatial scales within a VTCS by identifying existing collective action arenas, drivers, and limitations for the local community to engage in collective action through a mixed-methods approach with reference to the *Medde Rambewa* cascade system in the dry zone of Sri Lanka. Findings reveal that collective action arenas of VTCS-based local communities occur in response to common challenges posed by disturbed environmental equilibria and as a part of people's lifestyle, with outcomes contributing to climate change adaptation, livelihood support, risk or emergency preparedness, and promoting social identity. Economic incentives, rules, and fines imposed by Farmers' Organizations (FOs) were found to be drivers of currently adopted collective activities at the scale of village tanks. While collective action prevails beyond the scale of individual village tanks when governed by community institutions, shared resource uses, and social relationships among actors, individualistic resource uses occur in the absence of legitimate regulatory mechanisms. The study highlights the need for legitimate, scale-sensitive solutions to long-overdue common problems experienced by VTCS-based communities in order to foster meaningful collective action on a broader scale.

Keywords: collective action; cascade; ecosystem; community; scale; legitimacy; development; governance

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1. Introduction

Commonly shared resources have the potential to be sustainably managed by the local communities and multiple stakeholders, proving that the tragedy of the commons [1] can be avoided through context-specific response mechanisms, either by state interventions or through the collective action of local communities [2,3]. People living in rural areas and using natural resources are engaged in collective action on a daily basis [4], and effective collective action for watershed management has the potential to provide multiple economic

and environmental benefits to rural communities [5]. The nature of water resources to create interconnections at multiple scales within watersheds imposes the necessity of looking for common solutions to water-related problems [6].

Throughout history, local community groups involved in the use and management of common resources have been formed, often coinciding with the cohesion of livelihoods and lifestyles. However, in a context where societies face changes in socio-economic conditions as well as in resource use patterns, the natural formation of collective entities might or might not happen. The same is applicable to the focus of this study in the contemporary context of Sri Lanka, a developing country facing multidimensional challenges where complex natural-resource systems (specifically the management of large-scale watersheds) demand governance interventions to foster collective action. Currently, in the case of VTCSs in Sri Lanka, community-based, state-monitored organizations (i.e., FOs), which are established at administrative village-level units, stand as the governing body that represents paddy cultivators and facilitates limited collective functions related to lowland cultivation under village tanks. The FO is an organization that deals with matters directly related to paddy cultivation and irrigation water management. It is consistent with the tradition that communities have been autonomous of the tanks that irrigate their paddy fields. However, they are not mandated to cover all the functions necessary for the sustainable management of VTCS as a complex resource system. failing to address issues at cascade-level both in terms of membership inclusion and scope of coverage. Hence, it is vital to envision effective future governance mechanisms for VTCS, as the current institutional and policy landscape of Sri Lanka is highly unstable and unpredictable [7].

Commons research on many traditional resource management systems has recognized the importance of collective action in local communities. However, the effects of globalization, changes in patterns of resource use, and climate change scenarios have intensified the need for collective management on wider scales beyond the scope of small traditional communities, as in the case of Sri Lanka, which will be discussed in this paper. This study aims to clarify the dynamics of collective action in parallel to the expansion of the scale of socio-economic interactions and resource use patterns in VTCS-based rural communities in the context of multiple challenges.

The VTCS of Sri Lanka stand as a unique example of a complex resource system bound by hydrological and social relationships. VTCS are interconnected networks of village irrigation tanks where catchment forests, command areas, and human settlements are organized within the micro-catchments of the dry zone landscape of Sri Lanka, providing basic needs to human, floral, and faunal communities through water, soil, air, and vegetation with human intervention on a sustainable basis [8,9]. VTCS have been a fundamental feature of civilization in Sri Lanka [10], serving to be the lifeblood of dry zone communities over millennia and still irrigating approximately 25% of the paddy lands in the country [11], while providing multiple ecosystem services [12]. Given the unique features of sustainability, a characteristic model of VTCS in Sri Lanka has been recognized as a "Globally Important Agricultural Heritage Site" (GIAHS) by the Food and Agriculture Organization of the United Nations in 2017 [13].

The village tanks (aka small tanks or village irrigation tanks) are man-made structures (feeding a command area of less than 80 ha), and they form the constituent units of a VTCS. Village tanks and the ecosystem components linked with them have been managed by local communities throughout history; hence, they have been recognized as "communally" managed systems by previous researchers. In the traditional context, local communities had ensured that the rich catchment forests and micro-ecosystem components associated with village tanks were least disturbed and sustainably used [14–17], so that they performed as buffer zones between adjacent village-tank ecosystems, minimizing the externalities (impacts generated from resource use patterns in one location on another location). But, with the increased population pressure and resource-intensive agricultural production patterns that emerged as results of socio-economic and cultural transformations, as well as the impacts of climate change, the ecosystem components that once acted as buffer zones have

been degraded (either encroached on or neglected from maintenance), leading to the frequent occurrence of externalities across adjacent village tanks and communities, ultimately disturbing the hydro-socio-ecological equilibrium of overall VTCSs [18–20], threatening their future sustainability. When the buffer forest catchment exists between tanks, temporary abandonment of some of the village tanks would neither negatively affect the other functional tanks nor the entire cascade. However, since the buffer catchment forests, which retain water and minimize soil runoff, were subjected to degradation and disappearance, the condition of one village tank directly affected the resource endowment of the adjacent tanks and ultimately the entire cascade.

The notion of establishing a cascade-level mechanism to enable communities and other stakeholders to cooperate has been emphasized in recent policies and development efforts targeting the governance of VTCS in Sri Lanka [21]. However, attempts to implement such mechanisms through development interventions have failed over the past few decades, reportedly since the cascade residents had not felt the legitimacy of such mechanisms that had been tried out. These mechanisms have been mostly top-down approaches and have not been capable enough to address true social dynamics [22]. Therefore, even though the communities are aware of the cascade-level complexities and the importance of wider-scale cooperation, it has not been practically achieved so far. We propose that identification of existing pathways where people act in cooperation might be essential before establishing legitimate mechanisms to foster collective action across multiple social and spatial scales for the governance of VTCS in the contemporary context. Although the collective aspects of resource management and lifestyle in the traditional context of village tanks in Sri Lanka have been glorified in the previous literature, the relevance, roles served, boundaries of occurrence, and limitations for collective action across multiple scales within the broader territory of VTCS in the contemporary context have been underexplored.

In a context that is subject to multiple changes, when people's socioeconomic interactions and resource (land and water) use patterns expand beyond limited social and spatial scales, the motives by which they operate might be either individualistic, exploitative, or collective. The working hypothesis is that, in a complex resource system like VTCS, which is a collection of sub-units (i.e., village tanks) that are inherently designed to be collectively managed, the scale at which collective action takes place among local people in a resource-scarce context will widen in parallel to the expansion of their socioeconomic interactions and resource use patterns across multiple spatial and social scales (i.e., beyond a single village tank or a village unit), to a wider territory within the VTCS or beyond.

The diverging hypothesis is that, unlike in the traditional context, individual land ownership and resource utilization patterns do not remain limited within a single village-tank territory or a single village but instead expand to a wider territory of resource acquisition, most often within the territory of the VTCS. Based on these, the specific objectives of the study catering to the working hypothesis are:

1. To identify the cross-cutting challenges that demand the collective action of people residing within the cascade territory;
2. To explore the distribution of land resources owned and/or used by people living in the VTCS;
3. To analyze the different forms of collective action practiced by people residing in the VTCS territory, their boundaries of occurrence, roles, and limitations for engagement.

2. Study Context

2.1. Deriving at the Hypothesis

The latest research on VTCS in Sri Lanka highlights the importance of recognizing social networks and fostering collaboration among local communities and other stakeholders at the cascade level in order to minimize future climate risks and promote the adoption of polycentric approaches for adaptive governance of VTCSs [17,23]. In this backdrop, attempts have been made to formulate different institutional arrangements that can facilitate the collective decision-making and action of local communities to address common

resource-related challenges within VTCS, such as irrigation water scarcity, land degradation, and low agricultural productivity. For example, certain projects have tried to formulate cascade-level management committees with representation from FOs within a selected VTCS to address cross-cutting issues with the active participation of cascade inhabitants. But such previous strategies have failed with only short-term success due to a lack of legal recognition, power, and authority. The efforts continue up to date, with expectations to formulate a legitimate governance mechanism inclusive of multiple user groups and stakeholders at cascade-level [22,23]. In summary, one of the most pressing social and developmental issues within the context of VTCS in Sri Lanka is how to create a mechanism to enable a broader-scale-based (VTCS) collective action (cooperation) that extends beyond small individual tank-based communities.

There is an ample amount of previous literature on factors affecting collective action, with evidence from cases all over the world. Many studies on cross-scale collective action in watersheds have been nurtured by the Institutional Analysis and Development (IAD) Framework [24–27]. The IAD framework facilitates analysis and testing hypotheses about people's behavior in diverse situations at multiple levels of analysis and involves analysis of how rules, physical and material conditions, and attributes of community affect the structure of action arenas, the incentives that individuals face, and the resulting outcomes [24]. Context, action arena, and outcomes have been often recognized as key elements upon which collective action across different scales has been analyzed [28–31], especially with respect to social-ecological systems, including broad natural resource boundaries. Contextual factors include attributes of resources and users, socio-economic factors, cultural and environmental factors, as well as governance arrangements [24,26]. Action arena has been defined as any stage for social bargaining on which different actors may choose to cooperate or not, and it comprises an action situation, participants, and rules or conditions [28]. Action arenas may range from households, meetings, organizations, villages, and nations to the international level. It is hard to make a clear-cut distinction between factors falling under the context and action arenas. For example, institutions, including formal and informal entities, norms, trust relations, rules, and sanctions that structure social interactions, have been found to be key determinants of collective action, which could contribute to defining a context as well as action arenas. Among the other factors discussed in the literature, shared norms and social capital, especially with respect to past successes working together, facilitate collective action in new arenas. On the other hand, heterogeneity has been found to either facilitate or hinder collective action, depending on the situation [29–32]. Since the study scope considers the participation of multiple actors in collective activities and is not limited to one type of resource users, the effect of heterogeneity is relevant to the study context.

It has been found that people are likely to follow joint rules and arrangements only to achieve intensely felt needs that cannot be met by individual actions [33]. This might explain the influence of resource scarcity (which cannot be overcome at the individual level) on fostering collective action and serves as an important insight to probe the importance of the expected outcomes of collective action to people. Incentives (tangible and intangible) received at private or public levels can either be considered drivers for engaging in collective action or outcomes [34,35]. External or third-party interventions (by government, private, or non-governmental parties) play an important role, especially to provide legitimacy to mechanisms that are intended to foster collective action in large-scale scenarios [36].

However, most of the previous work referring to the above factors related to collective action on environmental resources within existing boundaries has mainly focused on the analysis of policies and institutions directly related to resource governance itself (forest management, water management, etc.). This study attempts to explore the factors that generate new cohesion and collective action among actors on a wider scale than within existing boundaries. We assume that such factors will be more closely related to social relationships that are a part of the everyday lifestyle of local people and to the sense of belonging and proximity to resources (water, land) based on territory of use and ownership.

Having experienced the failure of governments to form cascade-management organizations, the process should begin with exploring the possibility of social cohesion leading to new collective action. For this purpose, it is important to grasp the scope of people's physical activities, such as land use, as well as the accumulation of various human relationships and the scope within which their networks spread. This might shed light on facilitating legitimacy for collective action across multiple scales within the broader scale of VTCS.

2.2. Study Site

Medde Rambewa Cascade System (MRCS) is hydrologically located in the *Mee-oya* river basin and administratively belongs to the *Nawagattegama* Divisional Secretariat Division (DSD) of *Puttalam* District in the North Western Province of Sri Lanka. The area belongs to the Low-country Dry (DL_1b) agro-ecological zone of Sri Lanka. The cascade system encompasses two GN divisions, namely *Moragahawewa* and *Mahameddewa*. Demographic information of the MRCS is summarized in Table 1. There are 25 Village Irrigation Systems (VIS) within the cascade (Figure 1), with 24 minor tanks and an anicut. The average annual rainfall received in the area is 1174 mm, and the average annual temperature exceeds 28–29 °C. The study site is one of the locations under the implementation of the "Climate Resilient Integrated Water Management Project" (CRIWMP), which is a collaborative intervention funded by the Green Climate Fund through the United Nations Development Programme for the Sri Lankan government, while a civil society organization (South Asia Partnership for Sri Lanka) operates as the social mobilization arm of the project at field level [37–39].

Table 1. Demographic information related to the *Medde Rambewa* cascade system.

Demographics			**Total**
Local administrative divisions (GN Divisions)/Villages	*Moragahawewa* community	*Mahameddewa* community	
Total population	685	1512	2197
Number of households	266	543	809
Mean household size		04 members	
Number of village tanks	19	06	25
Main economic activity		(% of workforce)	
-Agriculture	51	44	46
-Government sector	26	6	12
-Private sector	9	13	12
-Self-employment (non-agricultural)	10	15	14
-Labor work	4	20	15
-Foreign employment	0	2	2

Refs. [37,38].

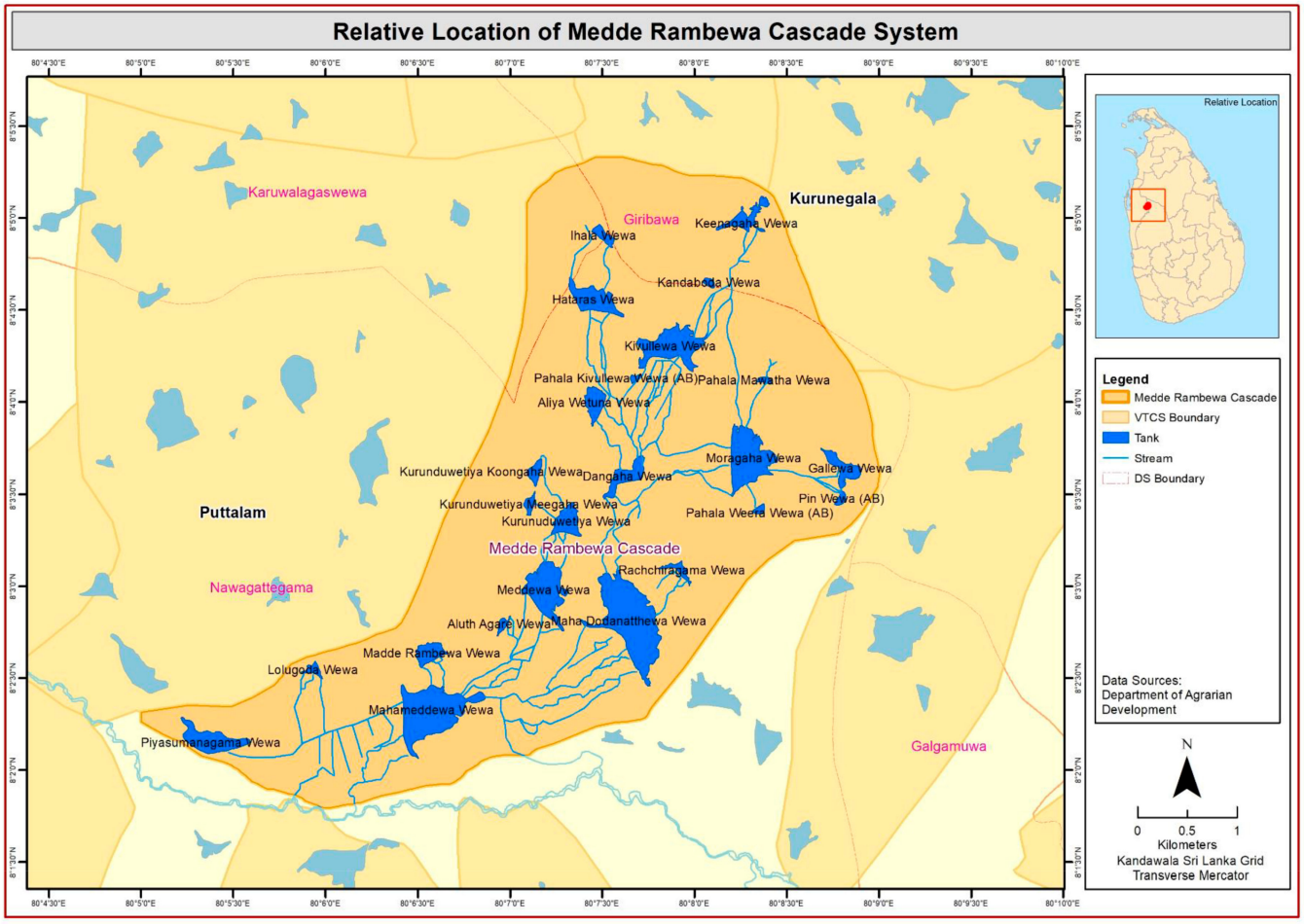

Figure 1. A diagrammatic representation of the *Medde Rambewa* cascade system.

3. Methodology

The concept of collective action within territories relates to the perspectives of proximity (territorial proximity and organizational proximity) that assume interdependencies among local actors based on the logics of belongingness and similarity [40]. A sense of belongingness and similarity emerge among people when their interactions are facilitated by rules or behavioral routines that they follow and when they share the same origins, the same systems of representations, or the same objectives [41]. When the hydrological and administrative boundaries of natural resource systems do not coincide, the territory or units of resource management will vary depending on people's interactions and local conditions. In the case of the Sri Lankan village tanks, although FOs serve within a single or several village tank units and fragmented administrative units, they cannot serve as an adequate governance entity within the broadest natural social-ecological territories (i.e., watersheds/basins). Considering the hydrological characteristics, water resource planning should be conducted at basin level, but this is only possible if the local community is ready to accept a basin-level organization as the management entity in the particular hydrological territory.

There have been several previous studies on the conditions that make such situations possible, or, in other words, provide "legitimacy". As discussed in organizational sociology, legitimacy refers to a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within a socially constructed system of norms, values, beliefs, and definitions. It is given by an external audience and represents the reaction of observers to the organization as they see it [42,43]. Legitimate pathways and provisioning of public goods are complex and context-dependent as they are subject to strategies pursued by the public, collective and private/individual actors [44,45]. We be-

lieve in the importance of a mechanism that is perceived by the local people as having legitimacy to foster collective action for broader (cascade-level) resource management. To this end, it is important to examine which activities are conducted at the watershed level within the existing scope of cross-scale collective action.

Existing forms of collective action that are undertaken by the residents were identified at the scale of (tank-/village-based) groups or sub-communities within the MRCS territory, while resource ownership and use patterns, participation in identified collective activities within the communities, drivers, and limitations for engaging in collective action were explored at the scale of households.

3.1. Research Design

A case-study research design [46] was employed, and a mixed combination of data collection methods recommended for collective action studies [34] were used, including focused group discussions (FGDs), in-depth interviews, participatory field observations, and a household survey. Data collection was carried out from March 2022 to January 2023. Multiple scales of data collection and analysis were included, including household, village, and cascade levels. Primarily, the cascade-level and village-level data were collected by conducting a total of four FGDs coupled with a problem-mapping exercise with community members representing both village-communities within the cascade (from March to May 2022). Each FGD was held for a time duration of 60 to 90 min. Two of the FGDs were held separately at each village; the third FGD was held with the participation of members representing both villages together at a common location; and the last FGD was held with the participation of community members representing both villages together with administrative officers representing local government authorities (Department of Agriculture and Agrarian Development Department) as well as staff members of development agencies operating at cascade level. All four FGDs were conducted (moderated and recorded) by the principal author, facilitated, and assisted by an expert in community mobilization. The background, purpose of the study, and objectives of the FGDs were clearly explained to participants at the introductory session of each FGD. Repetition of the objectives was ensured during each FGD, while the generated findings were summed up and reflected together with the participants before winding up each FGD. These procedures were adopted in order to ensure the validity of the FGDs. The composition of the FGD participants is given in Table 2 below.

Table 2. Composition of FGD participants.

FGD Number	Composition	No: of Atendees		Age Range (Years)
		Male	Female	
01	*Moragahawewa* village residents only	08	04	27–90
02	*Mahameddewa* village residents only	07	05	35–68
03	Residents of *Moragahawewa* and residents of *Mahameddewa* village	08	06	30–75
04	Residents representing both villages + local government officers and development project staff	09	06	30–75

The participants in FGD 01 and 02 were residents of each village. Participants in FGD 03 and 04 included a few members who had previously attended either FGD 01 or FGD 02 in their own villages. FGD 03 and 04 provided common platforms to generate findings on issues that are experienced by local people across spatial scales. FGD 04 led to the generation of findings on cross-cutting challenges experienced across social and administrative scales, from the perspectives of local people and local government authorities, respectively, in a common forum. A problem mapping exercise was coupled as a part of each FGD in

order to diagnose the challenges experienced by cascade-residents that demand collective action across multiple social and spatial scales. Participatory field observations were conducted, and thick description notes were taken during the visits as well as during attending the events organized by the community members throughout the authors' stay at the research site. Secondary data sources, such as annual reports of regional administrative institutions, government statistics, and project reports, were retrieved and used for analysis.

3.2. Household Survey and In-Depth Interviews

A household survey was conducted using a structured questionnaire with a representative sample of residents (n = 158) within the cascade territory from December 2022 to January 2023. Prior to administering the survey with the study sample, the structured questionnaire was pre-tested with a sample of 15 randomly selected respondents residing within the MRCS territory in order to ensure the effectiveness and validity of the questionnaire. The survey process was carried out by the principal author, supported by a team of four enumerators. Surveying at each household was followed by an in-depth interview with the household head or a responsible adult in the household. The total process of data collection at each household consumed a time range of 40 to 90 min, depending on the readiness of household members to provide information during the in-depth interview.

According to the census data, a total of 809 households reside in the two villages/GNDs belonging to the MRCS. But only 456 households reside within the MRCS territory, based on the village tanks. During the data collection, 158 out of 456 households (35% of the direct-cascade-based population) residing within the MRCS territory were surveyed, coupled with in-depth interviews within the above-defined time frame of two months. The sampling procedure was two-staged, involving stratified sampling followed by convenience sampling. Stratified sampling was conducted at the first stage to identify the strata within the MRCS. Accordingly, three strata representing the upper, middle, and lower elevations of the MRCS were selected, followed by the selection of six hamlets (three hamlets each from the two main villages) for conducting the survey. While three hamlets belonging to Moragahawewa village represented populations concentrated towards the upper and middle elevations of the MRCS, the three hamlets belonging to Mahameddewa village represented the lower elevation-based population residing within the cascade territory. This step was used to avoid the errors of bias in sampling and to ensure the representation of the VTCS-based community.

Given the high possibility of the absence of residents of any household during the time of visit for the survey, convenience sampling had to be utilized when visiting the households within each hamlet. In cases where the household head was absent or engaged at field work, either the enumerators located the household head at the field with their consent or the spouse or an adult of the household who could provide information were engaged with their informed consent. In cases where none of the household members of the originally selected nth house were present, the immediate neighboring house was visited. But, most importantly, the team of enumerators ensured surveying a representative sample (not limiting to the same age category or any specific category of other attributes) from each hamlet. It was ensured to cover the entire area of each selected hamlet and to make a second visit to households and collect data in cases where their exclusion might have caused biased results. In this way, the sampling method supports minimizing the errors of bias and missing out on data by ensuring a balanced representation of hamlets nested within the two main village-communities that constitute the bigger cascade community.

The structured questionnaire used for the household survey consisted of five main sections. Section one consisted of questions on basic household information, including socio-economic characteristics; section two explored the dependency of the household on village tank ecosystems and farming information. The third section included multiple-choice questions to explore the households' experience with changed climatic factors, followed by questions on the direct impacts of climate change and the types of climate change adaptation actions followed by the households. Section four was used to explore the partic-

ipation of the household in specified collective activities identified through the qualitative findings, the role played by the household, drivers, and limitations to their engagement. A follow-up question on the determinants by which each household defines the boundary of the community to which they belong was included. At the end of completing the structured questionnaire, an in-depth interview was held with each respondent (upon informed consent) by probing special facts revealed during the survey and by asking open-ended questions on engagement in collective action at multiple scales.

Data analysis was mainly qualitative and exploratory, and the findings were substantiated with statistical analysis of quantitative data using descriptive statistics. The chi-square test for homogeneity, Spearman's correlation tests to analyze associations, and Mann–Whitney U test for comparison of engagement in collective action of the two village communities were performed using IBM SPSS version 29.0.

4. Results and Discussion

4.1. Cross-Cutting Challenges That Demand Collective Action of People Residing within the Cascade Territory

Prior to making efforts to foster collective action for cascade-level resource management, it is essential to diagnose whether there exist pressing challenges experienced by people living within the VTCS territory that truly demand the need for such collective action across spatial and social scales. The first objective of this study has been formulated based on this proposition. Based on the analysis of FGD findings, challenges that demand cooperation of people across the could be categorized into two main aspects, related to natural environment and social life. The main challenges related to the natural environment were found to be (a) water scarcity (drinking and irrigation) and the unpredictability of rainfall; (b) the threat of wild elephants; and (c) the occurrence of flash floods. The situations linked with social life demanding cooperation were (a) a funeral, (b) organizing religious functions and cultural events, and (c) events at the local school.

4.1.1. Natural Environment-Related Challenges

(a). Water scarcity and unpredictability of rainfall

Water, land, and forests are the main resource bases that provide shared benefits to the village-tank-based communities, given most of their dependency on natural resources for agriculture-based livelihoods. Most of the VTCSs of Sri Lanka are located in the dry zone (spreading over 2/3rd of the total land area), where the annual average rainfall is less than 1750 mm [47,48]. Sri Lanka receives rainfall associated with two monsoons, namely the north-east monsoon and the south-west monsoon, that determine the two main paddy cultivation seasons of the year, i.e., the *Maha* (from September to March) and *Yala* (from May to August) seasons, respectively. The *Maha* season receives the most precipitation, while the *Yala* season receives relatively less precipitation. Inter-monsoonal rains occur in between these two main rainfall periods. [49]. While some of the agrarian communities in the dry zone have access to other major or medium irrigation water distribution schemes as well, others who do not have to highly rely on the limited rainfall and water storage of small/village tanks to irrigate their croplands. The study site (MRCS) has no direct access to a medium or major irrigation scheme as of now, other than the inter-connected network of village tanks (24) and an anicut deviated from a water conveying channel (*Nanneri-oya* anicut). They are the only sources of irrigation water for lowland cultivations, while the uplands are mostly rainfed. This makes the local communities highly dependent on village tanks since water turns out to be a highly scarce resource for them. However, the irrigation potential of most of the tanks has become insufficient to cater to the requirements of both seasons. Usually, most tanks will have enough potential to only irrigate the major (*Maha*) cultivation season. According to farmers, water storage in most of the tanks will be insufficient to irrigate the next (*Yala*) cultivation season after utilizing the tank water for the *Maha* season, so they often have to make adaptation decisions on adjustments in the

water sharing practices or shifting to the cultivation of low-water-consuming field crops other than paddy in the lowlands, both of which have to be carried out collectively.

"…the potential to irrigate existing command areas under village tanks become more challenging year by year. We hardly manage to cultivate Maha season but it is impossible to irrigate the command area during Yala season. Not only the water storage capacity of village tanks, but also the water holding duration has been obviously reduced than in the past. This is not an issue faced only by farmers of our village, but a common problem faced by all farmers in both villages…" says a 68-year-old traditional farm leader from *Mahameddewa*.

According to the residents, the unpredictability of rainfall has worsened the situation than ever before. The fact was confirmed by all participants, who stated that the duration and frequency of rainfall have become highly unpredictable, unlike in the past (tracing back to about two decades ago).

According to a female (aged 52) participant in one of the FGDs;

"…before 50–60 years, there were no limitations in access to clean drinking water in the area. We can remember our parents fetching water from the village tanks as well as from natural water springs inside the forest unlike today…".

"…Before storing the fetched water from tanks or natural streams, our mothers were used to the habit of putting a special type of plant seeds to the bottom of the clay pots, known as "Ingini" seeds rubbed on stones. This special type of seeds has the ability to remove hardness, toxins and impurities from water. In the past, "Ingini" was a very common plant found in the rich interceptor (Kattakaduwa (*Kattakaduwa* is the interceptor or land area between tank bund and the downstream paddy field, reserved mainly to safe-guard the tank bund. It creates a micro-environment with a wide diversity in the plant composition varying from aquatic plants to tree species found in the dry forest. *Kattakaduwa* serves to reduce tank seepage, prevent entering salt and ion polluted water seeping through the bund to paddy fields, and provides various needs of the community such as timber, fuel wood, medicine, fencing materials etc. [14])) zones of village tanks. But with the encroachment of interceptor zones by paddy farmers, the plant species also has become rare now…".

This reflects the nature of the closely interwoven lifestyle of local people that existed with the abundance of forest and water resources in the past, unlike at present. The underlying story of these expressions by residents reveals how the cascade resource endowment has been altered at present. Thus, not only irrigation water but also the scarcity of drinking water is a critical challenge faced by residents of both villages. The scarcity of drinking water within the cascade area is mainly due to poor water quality and a lack of sources. Since there are no rural water supply schemes available to provide water at household level, most people buy drinking water (purified by reverse osmosis) cans daily or weekly (usually from the local stores that sell drinking water or from the mobile water supply container that arrives once or twice a week). The government and project officers confirmed the severity of the drinking water scarcity while stating that it has been really challenging to provide a sustainable solution due to the lack of suitable water sources in the area.

According to these insights, water scarcity is one of the main challenges faced by the inhabitants of MRCS, irrespective of administrative or social boundaries, at present.

(b). Threat of wild elephants

Another of the most critical problems faced by the cascade-community members, irrespective of administrative borders, is the loss and damage to crops, property, and lives caused by elephant attacks. According to the community members, the temporary solutions given by relevant government authorities (i.e., the establishment of electric elephant fencing and issuing a limited number of elephant firecrackers) are insufficient to eradicate or minimize the problem. Hence, in the event of an elephant invasion of a cropland (Figure 2) or a home garden, those who first catch sight of an elephant attack will communicate the message to the neighborhood in order to seek help and to make others in the community prepared. Neighbors will get together and use firecrackers, make loud noises, and try to chase away the elephants. They will also make efforts to rescue any

member of the affected household who is injured by an attack. Even though some community members have made efforts at the individual level (by establishing electric elephant fences around individual lands), that has been found insufficient to prevent the problem.

Figure 2. Paddy fields attacked by wild elephants.

"…We anticipate elephant attacks during any time of the day now. Every effort we put in farming or landscaping either in lowlands or uplands, can become in-vain at any instance. We can never rely on the support of government officers during sudden attacks by elephants so we always help each other through communication and gathering together to rescue anybody affected. This is not a problem limited to only one village, but affects the whole area in proximity. Electric-elephant fencing is no more an effective solution to eradicate the problem…" stated a 35-years old (male) participant from Mahameddewa.

Even though the Wildlife Department has appointed officers to attend to human-elephant conflict issues in the area, community members do not tend to highly rely on the service. Therefore, a majority of community members rely on the mutual support of their neighbors or villagers when encountering elephant attacks.

(c). Flash floods

The low-lying plains of the cascade system bordering the two villages are affected by flash floods created by the overflow (spill) of a canal (*Nanneriya ela*) that runs across the upstream area. According to the community members, this condition has been aggravated during the past 10 years due to fluctuating rainfall patterns as well as upstream blocking by various constructions, changed land uses, and other human activities. These floods mainly occur during the major rainfall season almost every year and cause severe crop loss (to both paddy lands and upland cultivations) and force the affected members to temporarily move out of their residence places. As a remedy, the government has allocated slots of upland fields to affected community members to compensate for their losses due to flash floods. But not only is it just a temporary solution, but it has also triggered another serious issue of upland catchment encroachment beyond the allocated land (which is insufficient to compensate for the losses) as a result.

However, the community members who are unaffected by these flash floods collectively act to provide support to the affected fellow community members. They provide food, drinks, and sometimes temporary accommodation to affected families who lack another shelter to move to. This collective action is mostly voluntary and spontaneous in response to the crisis, although sometimes backed by the planned support from FOs as well.

4.1.2. Social Life-Related Situations in a VTCS-Based Community

(a) In case of a death/funeral

Support from others (including relatives and neighbors) during the loss of a family member was found to be very important to every member of the community, since it is a difficult life event faced by every household, irrespective of any social or economic gaps among each other. There are strong Death-Benevolent Societies (DBSs) established in the two villages, while most community members were found to have membership in more

than one. Unlike the FOs, all community members bear the membership, and the functioning is self-governed at the village level without the influence of any external party. There is a committee of office bearers elected upon the votes of all community members; they hold monthly meetings, maintain a welfare fund raised by community members themselves, organize certain events within each village, and mandatorily attend the tasks and fulfill the responsibilities in the event of a funeral at a member's household. The rules imposed by DBS on participation in monthly meetings and contributions are strictly internalized by all members. Despite the formal membership in DBSs, on most occasions, the community members attend funerals that occur in both villages, which is an indication of a mutual sense of belongingness to a community beyond spatial boundaries.

(b) Organizing religious and cultural events

Religious ceremonies at temples and performing traditional rituals related to villages' shrines receive high voluntary contributions from community members. In the case of flagship events related to village temples and shrines, most of the community members from both villages get together irrespective of economic or administrative boundaries (which could be attributed to the religious and ethnic homogeneity of the communities). Usually, the monks in charge of the village temples are recognized as having a respected advisory role in these community activities.

(c) Access to education

The study site being an area with minimum access to infrastructure and other facilities, the local school in the area is the common option available for parents from both villages to provide their children with a high school education. Therefore, school acts as an important focal point that unavoidably builds the cooperation of residents from both villages within the cascade territory. Nevertheless, the Sunday school held at the village temples is another platform that brings the children and adults from both villages together, not only regularly but also during cultural celebrations.

4.2. Distribution of Land Resources Owned or Used by VTCS-Based Residents

Catering to the hypothesis made on the expansion of individual resource ownership and usage patterns, the distribution of land resources owned by the VTCS respondents was explored in the household survey. According to the findings, 56% (the majority) of the households held ownership to paddy lands irrigated under village tanks (ranging from two to six village tanks) located in both villages Moragahawewa and Mahameddewa (i.e., the broader VTCS territory). As evident from the above, unlike in the traditional context where common people (except high-caste landlords) had ownership to paddy lands typically under one village-tank in proximity to their residence, in the current context, the majority of households own and manage land within a broader territory. According to a 70-year-old farmer from Moragahawewa, he holds positions as an office bearer in two FOs representing village tanks located in both villages within the MRCS, and the total extent of paddy lands owned by him is approximately 10 acres, distributed under six village tanks located within the cascade territory.

Although the technical concept of "cascade" emerged in discussions in the recent past, inter-linkages and relationships between adjacent tank communities have existed since ancient times, as a thin link in history [50]. Very limited previous research has attempted to scientifically validate some of the bio-physical and hydrological attributes of lateral and longitudinal connections among tanks within cascade systems [8]. Adding to, but not limited to, this existing knowledge on connectivity at the cascade-level, we emphasize that although the widely distributed resource ownership and usage patterns exhibit individual resource acquisition, they can serve as evidence of people's engagement across a wider spatial scale within VTCS. On the other hand, enhance the territorial proximity and belongingness felt by individuals/households to resources and institutions within the broader territory of VTCS.

4.3. Existing Forms of Collective Action in the VTCS Territory, Participation, Drivers, and Limitations for Engagement

4.3.1. Existing Collective Action Arenas

The existing collective action arenas of local people in response to experienced or anticipated challenges were explored in the study. To this end, the internal and external actors who are engaged in particular collective activities, the spatial or ecological boundaries, and the institutions through which they are coordinated were explored, as summarized in Table 3. Especially, the dynamics of existing collective action arenas for water and ecosystem management of village tanks will be discussed in detail, since it directly serves to understand the issues of scale and extent of existing legitimacy for fostering collective action in cascade-level resource governance.

Table 3. Existing collective action arenas within the *Medde-Rambewa* cascade territory.

Challenge/Situation	Action	Internal Actors	External Actors	Spatial Boundary of Action	Collective Entities/Institutions
Irrigation water scarcity	(a) Collective water sharing (*Bethma* (Bethma is a practice that temporarily redistributes plots of land among shareholders (paddy landowners) in part of the command area (territory) of a tank (reservoir) during drought periods [21].)) (b) Seasonal cultivation planning meetings (c) Cleaning and maintenance of village tank-infrastructure	Paddy farmers	Department of Agrarian Development, Department of Agriculture, Project staff from development agencies	Individual village tanks	FO
Ecosystem degradation	Ecosystem restoration activities (Tree-planting, construction of contour soil bunds to minimize soil erosion in the immediate tank catchments)	Paddy farmers and residents living closest to ecosystem components		Ecosystem components of individual village tanks (*Kattakaduwa* and *Gas-gommana*)	FO + homestead owners based in the immediate tank catchment areas
Maintenance of community plant nurseries	Production and sharing of planting materials through community nurseries (for home-gardens and replanting programs)	Women farmers (specially upland and home-gardens)		Village level	Women's Farmer-Organizations
Labor scarcity	Labor sharing (*Aththam* (*Aththam*, a strong social norm that structured the behavior of the farmers to share labor which eliminates or minimizes the requirement of paid external labor in farming activities. A group (called as *Aththam* group) of 10 to 20 farmers voluntarily work in each member's farm on a rotational basis, especially in tasks of transplanting, weeding and harvesting. Hence, Aththam group is more similar to a self-help group [51].))	Neighbors, relatives, and friends	-	Depends on those who are involved	Informal groups
Threat from wild elephants	Prevention of wild elephant attacks	Lowland and upland farmers, homestead owners	Wildlife Conservation Department, Agrarian Development Department	Both villages	FO (for paddy lands), Elephant-fence protection society, Informal neighborhood groups
Flash floods	Support when affected by flash floods	Residents of both villages	Divisional Secretariat office, Disaster Management Centre	Both villages	Informal groups
Death (funeral)	Organizing the funeral, providing food and financial support to the family	Residents of both villages	-	Both villages	Death Benevolent Societies, Temple
Religious and cultural functions	Organizing religious ceremonies and Sunday	Residents of both villages	-	Both villages	Temple Welfare society, Shrine
	Performing village-tank rituals (before commencing cultivations and after harvesting)	Villagers	-	Village level	FO and village community
Access to education	Welfare of the local school	Residents of both villages	Zonal Educational Department	Both villages	School welfare society, Old Pupils' Association

4.3.2. Household Participation in Collective Action at the Scale of Village Tanks

Reflecting on the findings of FGDs and in-depth interviews held with community members, the collective responses of people that have emerged in response to intensified challenges resulted from impacts of climate change (specifically, irrigation water scarcity and indirectly ecosystem degradation) could be recognized as forms of collective adaptation. The main adaptation-oriented activities identified were tank water sharing during scarcity, collective decision-making on farming activities, and participation in ecosystem restoration activities executed through FOs. The FO members, comprising a committee of office bearers elected as representatives from the same community, collectively hold seasonal cultivation meetings with the participation of local government officers (Agricultural Instructor and Agricultural Research and Production Assistant) and officers from development agencies when needed. The decisions on water sharing, sharing agrometeorological forecasts, and cultivation planning are made on this collective platform. In the past, FOs could be regarded almost as an exact representation (100%) of the entire community. But at present, although FOs account for the dominant majority of farmers within the community (around 70%), it cannot be considered an exact representation of the cascade community since other resource users are excluded from FOs. The collective practices of water sharing, seasonal cultivation planning, and cleaning and maintenance of village tanks, as explained below, are limited to the paddy farming community, while cascade ecosystem restoration anticipates the inclusion of all user groups, not just FOs.

(a) Collective water sharing during irrigation water scarcity: *Bethma*

In cases of prolonged drought, which makes irrigation water scarce to cultivate all paddy lands under a particular village tank, FO members decide to adopt a traditional water-sharing practice (known as *Bethma*) in order to share the limited amount of irrigation water available in the village tank by proportionately sharing the optimum irrigable paddy land extent among the number of farmers under the tank. In this case, the closest accessible extent of land that can retain water supply from the village tank will be selected with the consent of land owners, and each farmer will receive a proportionate area of paddy land (based on total paddy land ownership under the tank) to be cultivated in that particular season. Although there is a trade-off between personal economic gain and collective welfare intention for the paddy-land owners who agree to provide their own land to be shared among other fellow farmers, it could be observed that most of them prioritize the social value of sharing limited water resources in times of scarcity.

According to the analysis of survey data, the majority (80%) of the total sample of respondents have adopted *Bethma* practice during water scarce time periods. Out of them, while 90% of the respondent households from *Moragahawewa* village adopted *Bethma,* a comparatively lesser proportion (71%) of the respondent households from *Mahameddewa* village had adopted the practice. On analyzing the role played in contributing to the adoption of *Bethma* practice, a majority (53%) of the total respondent households were contributors of land shared during the adoption of *Bethma* practice. On analyzing the driving factors for their engagement in sharing tank water and paddy lands, significant positive correlations were found (based on Spearman's correlation test) with economic incentives r (156) = (0.34), p (<0.001), rules and fines imposed by the FO r (156) = (0.40), p (<0.001), and awareness on the shared negative consequences (economic loss) of not sharing limited water resources r (156) = (0.17), p (<0.005). This shows evidence that community members make choices about adapting collective measures when they are inevitable and imposed under a monitored set of rules along with proper awareness. This adds to the evidence from previous research suggesting that farmers are more willing to manage and share resource systems when water supply is relatively scarce rather than when absolutely scarce or abundant [52,53].

(b) Seasonal cultivation planning

In general, FOs hold monthly meetings as well as two main seasonal cultivation planning meetings annually per cropping season. The members make schedules for cleaning

and maintenance functions of village tanks, discuss problems and disputes and suggest solutions that are important for farming and resource sharing during the monthly gatherings. During the seasonal cultivation planning meeting, farmers make informed decisions collectively on the cultivation operations, including deciding upon the crop types (mainly paddy or other field crops during water scarce conditions) and varieties to be grown, schedules for land preparation and release of irrigation water from the tanks, etc.

At present, a seasonal weather forecast published by the collaboration of the Departments of Meteorology and Agriculture of Sri Lanka is issued, targeting to disseminate advanced climate information to the farmers to be used in cultivation planning. On the study site, the process is accelerated and facilitated by the intervention of the CRIWMP project in order to make the information available to farmers on time through the coordination of local government authorities. This could be recognized as an adaptive effort generated through the coordination of government, non-government, and community organizations in response to the exposed risk and uncertainty faced by farming communities to the impacts of climate change. Based on the findings of FGDs held with community members and key informant discussions held with local government officers, this initiative has facilitated the seasonal cultivation planning process by enabling the farmers to make more informed decisions on irrigation water sharing as well as planning for the cultivation of low-water-demanding other field crops during scarce rainfall conditions or for mid-/third-season cultivation during excess rainfall conditions.

It was found that all FO members attend the seasonal cultivation meetings due to the high importance of the decisions made related to farming operations, as well as the distribution of fertilizer subsidies and any other economic incentives given by the state or NGOs. Rules, sanctions, and economic incentives showed strong associations with the participation of farm household representatives in the seasonal cultivation planning meetings.

(c) Cleaning and maintenance of village-tank infrastructure

As stated under Agrarian Act No. 46 of 2000, maintenance and cleaning of tank bunds, field canals, and irrigation infrastructure are mandated functions of the farmer organizations. Based on the results of the household survey, 94% of the respondents (paddy land owners and tennant farmers) were found to compulsorily attend the cleaning and maintenance of tank bunds and canals, for which the main driving factor for participation was found to be rules and sanctions imposed by the FO.

(d) Village-tank ecosystem restoration

Even though tank water use for irrigation purposes is a limited privilege for FO members, the ecosystem services of village tanks and the ecological components are commonly shared by all community members, which makes it a shared responsibility of all to conserve and restore the ecosystem. Therefore, cascade rehabilitation programs are designed with the objective of engaging all community members (multiple user groups) for the restoration of tank ecological components and ultimately the whole cascade ecosystem.

From the sample, 68% of the respondents were found to be participating in collective village-tank ecosystem restoration activities (such as tree planting and demarcation of the ecosystem components, i.e., *Gasgommana* (*Gasgommana* is the upstream land strip above the tank bed, accommodating water only when spilling. It comprises natural vegetation with large trees and climbers. It also acts as a wind barrier, reducing evaporation from the tank water surface and lowering the water temperature. The roots of large trees make water cages, creating breeding and living places for some fish species. This strip of tree demarcates the territory between humans and wild animals [14]) and *Kattakaduwa*). Of them, the rate of participation was found to be higher in the *Mahameddewa* community (41%) than that of *Moragahawewa* (27%). The influence of development projects implemented in the area (which implemented cascade restoration actions that have led to increased awareness of the importance of ecosystem restoration and the negative consequences of not doing so), followed by a sense of self-satisfaction, were found to be strongly correlated factors with participation.

4.3.3. Driving Factors for Household Participation in Collective Action

The driving factors associated with household participation in collective activities that are directly related to village tank resource management and activity coordination were analyzed through Spearman's correlation test. Ten driving factors (that were identified as relevant to the context through primary findings from FGDs and in-depth interviews, backed with evidence from previous literature) were tested for associations with collective action engagement.

Economic incentives were found to be the most common factor, which was significantly correlated with participation in all four types of collective activities related to village tanks, which obviously reflects people's rational choice in engagement. Rules and fines were found to be strongly correlated with household participation in all activities directly coordinated by FOs, except for ecosystem restoration, since there are no rules or fines to mandate participation in ecosystem restoration activities. The strongest factor correlated with household participation in ecosystem restoration was influence from an external party (i.e., rehabilitation projects or government officers), followed by all other factors except rules and fines. This highlights the void created by the absence of a legitimate mechanism for ecosystem restoration, even though third-party involvement is present.

Self-satisfaction, social norms, and awareness of negative consequences were found to be closely associated with the adoption of *Bethma* practices, the cleaning and maintenance of village tank infrastructure, and ecosystem restoration. Feeling for others (altruistic thoughts) was correlated only with the adoption of *Bethma* and involvement in ecosystem restoration. Social rewards, respect for community leadership, and external/third-party influence were correlated only with involvement in ecosystem restoration.

Previous work on collective action has recognized the importance of the resource for local people's livelihoods, the longer time horizon of resource use, the large enough size of the management units so that they cannot be captured by individuals, a history of cooperation and networks, and recognition of local leadership as factors promoting cross-.

Scale collective action in watersheds. Institutional organizers or mobilizers and enabling legal frameworks have been identified as catalysts to facilitate such broader-scale collective action [54]. Most participatory watershed management initiatives adopt a community-based approach, erroneously assuming that people living within a particular geographic region will have strong shared common interests, but it is important to consider the different interests that clusters of people share as well as their relative power to assert those interests [55,56]. Hence, as long as legitimacy is not felt by the people through an effective mechanism, collective action for ecosystem restoration would not be achieved except for the participation of a limited proportion of residents, depending on a range of conditional factors that are perceived by each household as important. Table 4 presents the spearman's correlation matrix on the association of driving factors with household engagement in collective activities directly related to village tank resource management and activity coordination.

The mean level of participation of households in each collective activity (including both village tank-related and social life-related) was analyzed using the survey data, and the results are as shown in Table 5. Based on the results, people's participation in collective activities is evidently higher when affiliated with a specific institution (FOs, DBS, village temples/shrines) than when it occurs spontaneously.

A Mann–Whitney U test was performed to determine if there is a difference in the engagement of community members in self-governed collective action between the two village-based sub-communities within the cascade territory. A cumulative score for the engagement of households in self-governed collective action was used as the dependent variable. Scores (minimum = 0 to maximum = 5) were assigned for participation in each of the collective activities, namely, in the case of a funeral, cultural and religious events related to village temples, shrines, and tanks, in the case of wild elephant attacks, flash flood emergencies, and labor sharing. The score distributions in both sub-communities were similar when visually inspected. The self-governed collective action engagement score

between two sub-communities was found to be not significantly different between *Moragahawewa* (median = 83.5) and *Mahameddewa* (median = 76.2), U = 2801.0, standardized test statistic Z = −1.06, p = 0.291. This proves the fact that the engagement of people in existing collective action arenas that are entirely community-driven shows no difference at the village level.

Table 4. Spearman's correlation analysis on the association of collective activities directly related to resource sharing and activity coordination in village tanks with drivers of household participation.

Activity		Driving Factors for Household Participation									
		A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Collective water sharing *(Bethma)*	Correlation Coefficient	0.329 **	0.422 **	0.232 **	0.391 **	0.311 **	0.144	0.050	0.115	0.311 **	0.102
	Sig. (2-tailed)	0.000	0.000	0.003	0.000	0.000	0.072	0.531	0.149	0.000	0.200
Cleaning and maintenance of village tank-infrastructure	Correlation Coefficient	0.203 *	0.180 *	0.112	0.408 **	0.185 *	0.064	0.119	0.085	0.165 *	0.067
	Sig. (2-tailed)	0.011	0.024	0.163	0.000	0.020	0.425	0.136	0.286	0.039	0.401
Seasonal cultivation planning meetings	Correlation Coefficient	0.140	0.213 **	0.091	0.218 **	0.107	0.069	0.066	0.123	0.138	0.072
	Sig. (2-tailed)	0.083	0.008	0.259	0.007	0.185	0.395	0.414	0.129	0.088	0.377
Village-tank ecosystem restoration	Correlation Coefficient	0.411 **	0.274 **	0.289 **	0.123	0.364 **	0.177 *		0.167 *	0.281 **	0.627 **
	Sig. (2-tailed)	0.000	0.001	0.000	0.126	0.000	0.027		0.037	0.000	0.000

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). (A: Self-satisfaction; B: economic incentives; C: feeling for others; D: rules and fines; E: social norm; F: social rewards; G: peer pressure; H: respect to community leadership; I: awareness on negative consequences; J: influence of government/non-government organization officers).

Table 5. Mean participation level of cascade-based households in collective activities and outcomes.

	Collective Activity	**Mean Participation (n = 158)**	**Outcomes**
01	Village-tanks and farming related actions		
(a)	Collective water sharing (*Bethma*)	0.80	Adaptation, Livelihood support
(b)	Seasonal cultivation planning meetings	0.93	
(c)	Cleaning and maintenance of village tank-infrastructure	0.94	
(d)	Ecosystem restoration	0.68	Adaptation
(e)	Maintaining community nurseries	0.60	Adaptation, Livelihood support
02	Labor sharing (*Aththam*)	0.49	Livelihood support
03	Prevention of wild-elephant attacks	0.60	Risk preparedness and response
04	Support during flash floods	0.50	
05	Support in case of a death	0.98	Mutual sense of belongingness
06	Organizing religious events and performing cultural rituals	0.86	Sustaining social identity and shared values

However, the mean rates of engagement of two communities in development project-driven ecosystem restoration actions vary from each other according to descriptive results. The mean participation level of *Moragahawewa* village-community is lower (0.61) than that of *Mahameddewa* village-community (0.74) for project-driven ecosystem restoration activities. The higher dependency exhibited by *Mahameddewa* community members on village tank resources than *Moragahawewa* community members might be one cause for this differ-

ence in restoration engagement. This observation provokes the need to reflect on the different rates of engagement of community members in project-driven cascade-ecosystem restoration actions [57] that are implemented with expectations of larger-scale "cascade-level community" participation.

4.3.4. Limitations for Engagement in Collective Action

Identifying the limiting conditions for cascade inhabitants to engage in collective action is equally important as understanding the existing collective action arenas in order to gauge the possibility of fostering collective action on a broader scale within the cascade territory. From the perspective of local community members, three main limiting conditions for engaging in collective action in the contemporary context were identified through FGDs and in-depth interviews and triangulated with the survey findings. First, due to the risk and uncertainty associated with multiple environmental stressors and a severe economic crisis, individualistic priorities have limited the time available for community members to engage in voluntary collective actions (especially when they are not affiliated with a specific institution and do not generate immediate benefits). Based on the survey findings, although the majority of households (77%) still rely on village-tank-based farming as their main income source, 23% of households rely mainly on non-agricultural income sources. Especially the younger generation tends to prioritize financial independence through diversified income sources (by migrating to urban areas, trying out small-scale businesses, eco-tourism ventures, etc.) rather than relying on village-tank-based farming. And community members stated that the temporary solutions provided by the government or external parties have not been capable of solving their long-overdue recurring common problems; hence, they should find their own ways. Secondly, free labor contributions for collective actions create an economic loss for individuals (in terms of time, energy, and money) since labor has become an expensive commodity within the community. Even though labor sharing and free labor contributions for collective actions were a very common scenario in the traditional context, labor has become a highly priced, limited resource nowadays. Thirdly, the community members identify the decline of traditional leadership and shared values on the use and conservation of common natural resources within the communities as another cause for the lack of voluntary engagement of inhabitants for collective action, unless it serves an essential need.

In previous research, attributes of heterogeneity such as economic wealth, access to land and common pool resources, disagreement of authority in leadership, and being emotionally distant from the resource/issue of concern (for example, the importance of cascade ecosystem restoration in this case) have been identified as barriers that counteract successful collective action [27,54,58–61]. The study findings comply with these factors while adding emphasis on the influence of risk and uncertainty (both with respect to natural causes as well as the weak legitimacy of governance mechanisms) on limiting the potential for collective action. Future research potential exists to in-depth explore the possible legitimate and socially sensitive mechanisms that can foster meaningful collective action at the VTCS level.

5. Conclusions

Collective action arenas within the selected VTCS-based community were found to have been generated as responses to cross-cutting common challenges experienced by the local people related to the natural environment as well as social life. These collective action arenas were found to serve main roles in climate change adaptation, livelihood support, risk/emergency preparedness and response, establishing a mutual sense of belongingness, and sustaining social identity along with shared cultural/religious values. Economic incentives and rules/fines imposed by community-based organizations were found to be closely associated with the participation of households in collective activities related to village tank functions. Engagement of people in collective actions seemed to be higher when affiliated with a well-established institution (FOs, DBSs, or village temples/shrines). The

only collective activity that showed a strong association with external influence (government/NGO parties) was ecosystem restoration, which had a comparatively lower mean level of participation than other community-driven activities related to village tanks. With respect to fostering collective action for the restoration of VTCSs in the contemporary context, we conclude that although it might be less challenging with farmers (given the relative importance they place upon village tanks due to livelihood dependency and boundedness to the rules and sanctions of FOs), in contrast, it would be more challenging to foster inclusive, cross-scale collective action with non-farming community groups unless the true common problems faced by community members are addressed through legitimate actions. Therefore, existing institutions through which collective action occurs, such as FOs, DBSs, village temples/shrines, and local schools, should be recognized as focal points in instrumenting an inclusive cascade-level governance mechanism without exclusively limiting it to the farming community. Any new legitimate mechanism should be have the potential to minimize risk and uncertainty (associated with climatic and economic factors), high opportunity costs in contributing free labor, and involve strategies to make effective use of traditional community leadership and recognize shared community values, which were found to be the main limiting conditions in the current context to engage in collective action from the people's perspective. It is evident that collective action can occur beyond the scale of individual village tanks when governed by strong community institutions, shared resource uses, and social relationships among actors, yet individualistic and exploitative actions occur in the absence of legitimate regulatory mechanisms. We pitch the conclusion through people's voices: "…we are aware that our collective participation for cascade-ecosystem restoration and sustainable resource management is vital, but it does not make an urgent sense to engage in temporary actions while we continue to suffer from uncertainty and critical common challenges which remain unsolved and unattended by the authorities throughout a long time…".

With this, the study highlights the need for legitimate, scale-sensitive solutions to long-overdue common problems experienced by VTCS-based communities in order to foster meaningful collective action on a broader scale. According to the research hypothesis, the diagnosis of vital social interactions and resource use patterns of local people is essential to facilitating legitimacy in collective action arenas that can surpass spatial and social boundaries in order to foster collective action into a reality rather than limiting it to a developmental illusion.

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