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# Protect the water sources through community participation on the micro-watershed management in the Region of Oecusse Timor Leste

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**Abstract.** The attention given to water management has increased lately due to the growing problem of water scarcity worldwide and rising conflicts between water users. Research conducted in the region of Oecusse on the western side of Timor Leste. As is typical of the uplands of Timor-Leste, the ecology is fragile and bears the negative impact of slash-and-burn agriculture, which also negatively impacts already inadequate water resources. The lack of clean water sources, sanitation and hygienic practices in the area lead to health problems. This research is focusing on how the implementation, challenges, and impact of protect community water sources through the adoption of micro-watershed management. This study uses a qualitative approach. The sample was taken by purposive sampling, by selecting a number of respondents who were involving and knowing how efforts to protect water resources by using micro-watershed management. The research found that community was participating on the micro-watershed have fenced to protect the springs from encroachment from wild and farm animals. One of the important factors of community participation is the establishment of the Water Management Committees (WMC). It is focused on conservation and protection of micro-watershed. Access of women and marginalized groups to water was better, particularly in those belonging to WMCs which had established rules on distributing and collecting water. With well-organized management of water collection, the residents had certain schedules for collecting water and it was time-saving for them.

## 1. Introduction

The attention given to water management has increased lately due to the growing problem of water scarcity worldwide and rising conflicts between water users. Participation of local people in water management is now seen as a crucial prerequisite for the conservation and sustainable use of scarce water resources [3]. Watersheds are generally large, and diverse individuals and groups have an interest in how they are managed. Nevertheless, micro-watersheds also have important meaning in many places because of their role in 'clean' water sources for local communities. Movements of water, soil, nutrients, and pollutants between different parts of a watershed create physical connections between people who are distant from each other. In economic terms, watersheds are filled with production and consumption externalities.

Timor-Leste is one of the least developed economies in Southeast Asia and the Pacific region and is essentially agriculture based. However, agricultural output is very low, and most of the country



suffers from food shortages for at least four months of the year. Most rural communities also suffer from water shortages. While the earth's endowment of freshwater remains constant, Timor-Leste, like almost all Asian countries, continues to see its per capita freshwater resource levels fall as human consumption rises. Any development approach must now also address the changing weather conditions because Timor-Leste, like the rest of the Pacific countries, is increasingly being affected by severe weather events as a result of climate change. This extreme weather, whether it is in the form of intense rainfalls interspersed with periods of drought, or simply untimely rains, has a serious impact on groundwater, soil degradation and erosion, and ultimately agricultural production and nutrition. In a study by the UNDP in 2013 [14], the findings concluded that climate change in Timor-Leste could lead to decreases in agricultural yield and potentially severe decreases in soil water content, especially in regions of Oecusse, Manatuto, Baucau and some parts of Covalima. Without reliable access to water, the quantity and quality of crop production are uncertain, which in turn affects food security.

The region on the western side of Timor Island, Oecusse, constituting an area of some 815 square kilometers, is noteworthy for its status as an enclave. Separated geographically from the twelve other districts that make up Timor Leste, Oecusse sits entirely within an area encircled either by Indonesian West Timor or the Ombai Strait [4]. Without a land bridge connecting it to the rest of Timor-Leste, the enclaves situated approximately eighty kilometers to the west of the main international border separating Timor-Leste from Indonesian West Timor at Batugade (see Figure. 1). Its geographic isolation from the capital city Dili merited a constitutional promise in 2002 for special considerations, now taking shape in its status as a Special Economic Zone. In January 2015, the Council of Ministers handed over governance of the enclave to the Regional Authority of the Special Administrative Region [16].



**Figure 1.** Map of Region of Oecusse Timor Leste

The region of Oecusse is characterized by low food production levels, an absence of adequate clean water supplies especially in remote areas, and isolation from the rest of the country. As is typical of the uplands of Timor-Leste, the ecology is fragile and bears the negative impact of slash-and-burn agriculture, which also negatively impacts already inadequate water resources. Geographically, traditionally, human settlement in Oecusse has been concentrated in the mountainous interior, rather

than near the coast—as is generally the case across Timor [4]. Income generation is mostly dependent on dry land farming producing maize, paddy, cassava, potato and other vegetable cultivation from April to July. Agriculture production is poor and is increasingly being affected by the irregularity of the dry and wet seasons through climate change, resulting in ever more harvest failures.

The lack of clean water sources, sanitation and hygienic practices in the area lead to health problems. Some communities are more than two kilometers from water sources in the form of springs or rivers. Collecting water is mainly carried out by women and children, increasing the burden on these already vulnerable groups. Many of the water sources are contaminated resulting in a host of water-borne diseases, such as diarrhea, which particularly affects the elderly and children under five. Development in this region is constrained by the region's isolation; traditions that limit equitable participation; illiteracy and multiple languages; long dry seasons, fragile soils and a rugged landscape; as well as, poor infrastructure and few government services.

In November 2014, The District Water and Sanitation Service (SAS) of Oecusse called a meeting to request all NGOs to work closely with their communities on how to protect natural resources. Based on the field findings, World Neighbors (WN), an international NGO, and their local partners were implementing an integrated micro-watershed management, with a focus on water and sanitation activities, community participation and ownership on a multi-stakeholder platform results in greater sustainable impact on the Increasing Community Resilience in Oecusse Timor–LesteProject (ICRO Project).

This research is focusing on how the implementation, challenges, and impact of protect community water sources through the adoption of micro-watershed management technologies and a community-based natural resources management approach. This is particularly prominent in the rural water sector, where there has been a shift from state-led, technocratic water resources management programs to an increase of 'participatory' and 'community-based' water resources management [12].

## 2. Method of research

A watershed is defined as a land area that drains into a stream [2]. Watershed management refers to “the use, management, and investment in a number of inter-dependent resources within ‘watersheds’” [13]. It implies not only to the management of water but that of all natural resources in a watershed such as forests and other land uses. Watersheds are unique areas that are often characterized by their heterogeneity of biological and socioeconomic attributes. The micro watershed is a coherent ecosystem unit in the smallest unit of a geographical area with natural characteristics such as slope, land, drainage, and geomorphology [8,9].

Watershed classification based on the size of the area from several institutions shows there is no agreement on the size of the area the micro-watershed. Based on the regulation of Direktorat Rehabilitasi Lahan dan Perhutanan Sosial No. P. 15/V-Set/2009 [8] concerning Guidelines for the Development of Micro Watershed Model Areas called micro watersheds are watersheds with an area of <5,000 ha. Compare, for example, the definition of the Ministry of Agriculture, India defines a micro-watershed namely the sub-sub-watershed which has an area of between 500-1,000 ha [6]. While [9] recommend the micro-watershed boundary is approximately 1,000 ha.

This study uses a qualitative approach. The sample was taken by purposive sampling, by selecting a number of respondents who were involving and knowing how efforts to protect water resources by using micro-watershed management were carried out by NGOs especially supported by WN. Researches developed and utilized simple structured questions, in Bahasa Indonesia and guided by the local interpreter to interview for each of the key-implementing actors, International and local NGOs, communities, and government officers. 25 key informant was interviewed. In addition, researchers also visited 13 micro-watershed location from 82 micro-watershed project sites. Of particular importance was to create a screen for each interview to capture the contribution or value added to protect water resources by community partition on micro-watershed management. The purposes of the

interviews were to explore the opinions of the stakeholders on implementation, achievements, constraints and sustainability strategies to protect water resources.



**Figure 2.** FGDs with the community in the around of the water resources

As part to enrich the findings, community participation and impact of the project were reviewed at the level of the intended beneficiaries and community via village level stakeholders. Hence a sample of 13 communities was selected taking into account the number of days available for field visits and a number of evaluators deployed, projects covered by the partner organization, villages and community that the organization worked in. To gain a more comprehensive insight on the program achievement and impact based on a ‘sampling-sound’ data calculation, the sampling process used the following procedure and techniques to obtain data from around 20% sampling group (Baero/villages), the sample selected was taken from 13 from 70 Baero. Data were collected using different kind of methods, FGDs, interview and direct observation.

### **3. Community participation on the micro-watershed management: finding and discussion**

The 2015 Census recorded Oecusse population as 68,913, a 20 percent population increase since 2004 (an average population growth rate of 2 percent per annum). Oecusse land mass of 817 square kilometers corresponds to 5.5 percent of Timor-Leste’s total land area [15]. In the case of Timor Leste, traditionally, human settlement in Oecusse has been concentrated in the mountainous interior, rather than near the coast—as is generally the case across Timor. This preference has been noted as characteristic of settlement patterns across the Indonesian archipelago. Multiple factors are likely to contribute to this; altitude offers better defence against invaders, a much lower incidence of malaria, and relief from the heat of coastal areas. Oecusse’s higher altitudes also receive substantially greater rainfall over a rainy season that can last two months longer than in the coastal strip, and groundwater reserves are more plentiful [1].

During the Indonesian period, part of the population was forcibly relocated to the coastal fringe between the border posts of Sakato and Citrana and the low-lying alluvial floodplains along the River Tono in the sub-district of Pante Makassar—Oecusse’s ‘rice belt’. This was ostensible to maximize use of cultivable land, but it also allowed the state greater control over the population [4]. Since 1999, some of these people have abandoned the coastal lowlands and returned to the mountains. Of those who have not returned many still look to the mountains as the center of their family, social and ritual activities (Metzner in [4]). However, this statement pattern also has implication especially to clean water access. Some communities are more than two kilometers from water sources in the form of springs or rivers. Collecting water is mainly carried out by women and children, increasing the burden on these already vulnerable groups. Many of the water sources are contaminated resulting in a host of water-borne diseases, such as diarrhea, which particularly affect the elderly and children under five.

Although Oecusse is known for its abundant water, during the dry season rainfall can be as low as just one millimetre; farmers far from irrigation channels or rivers can have limited to water. Irrigation



canals completed at Tono stretch along 23 kilometres and will provide reliable water for 3,000 hectares of agricultural land. Access to reliable water supplies greatly increases the potential for reducing food insecurity. There are several ongoing initiatives ranging from technical assistance, access to funding, and value chain development under the Regional Secretary of Agriculture to improve the sector. In addition, 23 horticultural centres have been supported to produce organic vegetables, increase diversity and build fish ponds [15].

Since 2016, WN and local partners, supported by USAID funding, was implementing a project that adopted an integrated approach that will relate water resource-based management to a human and environmental development paradigm. A holistic and participatory approach adopted in the implementation of the project, which will ensure that the initiative is community-oriented and the process of social change is endogenous. At the practical level, this project was done through tree planting, digging absorption wells, water catchment holes, hedgerow terraces, water traps and other appropriate micro-watershed management technologies around water sources to reduce run-off and loss of water and blocking off from livestock to prevent contamination, as well as the enactment of local laws to protect and maintain them.

Based on baseline data, a total of 82 water springs is founded in project location (Figure 2). The majority of these water springs are on private land. Even though they are on private land, the community may access the water spring. This is certainly influenced by the communal nature of rural communities. However, it is not easy to invite landowners to be involved in the protection of these springs. This is because it will have an impact on the access of landowners to manage their livelihood resources. Generally, the fields near this spring are more fertile. This includes the source of feed for their livestock. It is not uncommon for livestock to be kept in the area of water springs - and this results in water springs contamination. Sometimes, in one micro-watershed area, the number of landowners is more than one person. Ensuring landowners to be involved in protecting these springs becomes much more difficult.

Up to the first year of project implantation, the project had protected and conserved as many as 32 water springs in the project location, where the residents now have better access to clean water. Achieving this figure is very good if you see the complexity of land ownership around the spring. By fencing the water spring area about 1 hectare wide, the water spring was adequately protected from wild and farm animals bu using the wood and trees (Figure 2). In addition, some water springs had already been protected/covered so that they were protected from all kinds of trash like leaves. The residents said that the water springs were clearer.



**Figure 3.** Water resources protection in the micro-watershed area.

Overall, the objectives of the project are in line with the needs of the community and the government's priority. The authority of Oecusse, through Mr Regio da Cruz Salu, *Secretario Regional Para a Agricultura e Descenvolvimento Rural* (Regional Secretary for Agriculture and Rural

Development), strongly stated that the program was very much aligned with the government's programs. Water supply became a new hope for all the residents in the project locations, especially in the dry season. They were aware that if the water supply were secure, their opportunity to access clean and safe water would be better. The farming land improvement was also appropriate to the community's needs, particularly because the land was located in hilly areas with high erosion rates. Contour farming technology that had been introduced was highly appreciated as a technology that could improve the farming land condition. People were aware that if their farming land was better their opportunity to obtain better agricultural crop would be bigger.

So far, there had been 32 water springs that had been protected from those targeted during the project implementation. As most of the community farmland is on sloping areas, contour farming and micro-watershed management are necessary. And along with micro-watershed management practice, planting perennial trees at the farmland boundary was also suggested. Communities have planted 12,600 trees in their water sources areas. So far, the resident's knowledge and practices on land conservation, water spring management, and hilly area farming would possibly sustain. However, the capability of plants that could retain water longer under the ground as well as increase water supply would require a test as there was no proof yet about it and some plants did not grow. Another aspect was the engagement of the government officers in activities, which in some areas went well. It was expected that in the future there would be a handover of the program so that it would be continued by the government when the project ends. In addition, the existence of Water Management Committees (WMCs) and dues collected by the water users in all water spring areas became a positive indication of responsibility and sense of belonging, which bodes well for the future.

However, the sustainability of some activities pertaining would require a test due to the following indications: firstly, the types of plant and short-term plant cultivation in the conservation areas could be disturbing for water spring area conservation. In addition, some plants were indicated unsuitable for the conservation areas as they were water absorbent and some plants produced wood with economic values. Secondly, the fencing of the protected and conserved areas was high cost. Based on the previous which implemented similar activities, it showed that the residents did not fix the fences when they were broken. The issue of land ownership in the water spring areas are not uniform (individual, communal etc.), and there is not yet any Timorese or Oecusse-specific law governing conservation areas both concerning legal and customary forms. The condition could bother conservation activities in the future if the owners or their heritors end the agreement. Thirdly, agricultural best practices (contour farming, etc.) were not practiced by the whole community in respective areas but limited to farmers who are members of farmer groups mentored through the program. It is a huge challenge for the project to convince the community to keep consistent in changing to more sustainable agriculture best practices, as slash and burn is not only the traditional method used for as long as people can remember, but is also considered as a ritual within communities.

This research finding shows that community participation is one key to the success of the micro-watershed management. This finding was contradictive to the research of [5] in sub-watershed of Keduang. Indrawati found that the community empowerment in watershed management has not yet met the concept of community empowerment and has not been able to be said successful, because the community does not have power or authority to make decisions autonomously. In this point, as mention by [7] that community participation in all processes would ensure that there is continuity in the governance structure of these watersheds for sustainable productivity

One of the key important factor in the project is establishing new Water Management Committees (WMC) or revitalize existing WMCs for each water source that is being conserved and protected. This WMCs are intended to take the main role of maintaining and continuing the activity related to the water source after the project finishes. The WMCs will play an important role with support from the local government to achieve the long-term impact of the project. For example, the trees planted at the conserved areas during the three years of the project life are still in need of intensive care and the possibility of the trees is not growing is still high, especially given the serious water shortages experienced this year. It is expected that the WMCs will do the job of taking care of these trees that

will later bring benefit to the water source. Another impact was that the distribution of water in some water springs was more equal. Access of women and marginalized groups to water was better, particularly in those belonging to WMCs which had established rules on distributing and collecting water. With well-organized management of water collection, the residents had certain schedules for collecting water and it was time saving for them.

However, since the fencing relied more on the residents' experience, the structure did not take the safety aspect for women and children into account to minimize accident risk whereas, in our observation on the water springs, we found that most family members who collected water were women. The project needs to encourage the improvement of the fence design that is gender sensitive and to encourage men to take a role in household water supply. The fence that was built to protect the water spring conservation areas for example still used the old style, in which a fence did not have any door. Therefore, in the areas where water had to be collected, there was no improvement in regards to easy access for women and children to the water sources.

#### 4. Conclusions

The research found that the successful of project implementation to protect community water sources through the adoption of micro-watershed management technologies and a community-based natural resources management approach. It was a result of changes that occurred in the water springs that were fenced to protect the springs from encroachment from wild and farm animals. Among the vulnerable groups, such as old women and children, the level of consumption has increased due to the rules regulating the time and volume of water that is allowed to be collected by each family for the sake of even distribution. Community participant also increases due establishment of WMCs at all protected locations, both those established before and during the project and which generally require the regular payment of dues.

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