

Public Perceptions on the Problems of Kuranji River Basin Management in West Sumatera, Indonesia

Rudi Febriamansyah¹ and Finna Nurpasari²

¹Faculty of Agriculture, Andalas University, Kampus Unand Limau Manis, Padang, Indonesia

²Graduate Program, Andalas University, Kampus Unand Limau Manis, Padang, Indonesia

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Abstract: Batang Kuranji is one of the main rivers that divide the city of Padang, West Sumatera, Indonesia from the Bukit Barisan mountains in the east to the Indian Ocean in the west, with a length of about 25 km, and a river basin area of 202.7 Km². Over the last three decades, there has been an increase in the frequency of problems caused by the declining quality of watershed management, such as upstream landslides, and flooding downstream in urban areas. This study attempts to explore and identify the watershed management issues, from upstream to downstream, based on community perspectives along the river basins: upstream, middle and downstream. Qualitative and quantitative data collection methods were applied through surveys with respondents, semi structured interviews with key informant and Focus Group Discussion with stakeholders. In general, each community group along the river basin has a similar view of the more frequent flooding problems and the higher of flood. However, the factors that cause the problems for each community are different with each group blaming one another. This study explores these differing views between groups and provides recommendations for policy makers towards integrated management.

1 INTRODUCTION

For over 20 years the world has acknowledged the integrated nature of water resources management and has worked together to form acceptable agreements. First initiated at the United Nation Water Conference (UNWC) in Mar de Plata, Argentina 1977 and then formed on United Nation Conference Environment (UNCED) and Development in 1989 (Sheuman, 2001). One of the key elements of integrated natural resource management is the need to involve stakeholders in the decision-making process. This means coordinating policy at all levels from national ministries to local government or community based institution (GWP (Global Water Partnership), 2000).

Current management patterns should be transformed towards adaptive management, integrating all stakeholders and holistic in the sense of incorporating elements that support the sustainability of water resources, i.e. environment, technology, economy, institutional, and cultural characteristics. Important terms related to integrated management are Integrated Water Resources Management (IWRM), Integrated Water

Management (IWM) and River Basin Management (RBM). Though there are some differences between them, they all emphasize a process that is coordinated and the relationship between sustainability and economic and social welfare (Stalnacke & Gooch, 2003). The development of the concept is due to the issues of water resources that trigger the tragedy of the commons due to the diversity of interest in the use of water causing scarcity of water resources, and causing conflicts in various places. In addition, the problems and challenges in water resources management practices in Indonesia imply that the government is 'milking' other parties (Sriyono, 2015). Several challenges facing developing countries today include; cost and benefits being distributed unevenly, conflicting uses, the use of technology, uncertainty in watershed management and implementing the participatory approach (Kerr, 2007). Because water is limited, participatory approach should be implemented between users, planners and a policy maker at all levels, the important role of women, and knowing generally that water has economic value (GWP, 2004).

This paper explores community perceptions on current issues and challenges, particularly on case studies in one of the developing regions of Indonesia. Was the concept of IWRM able to address the problems and community conflicts of water use?

2 METHODOLOGY

This research uses an exploratory approach with qualitative and quantitative data collection methods. Surveys were used to identify the community perspective on the problems of the Kuranji River from upstream to downstream. In addition, qualitative data are collected from key informants by using semi-structured interviews method and Focus Group Discussion is done with relevant stakeholders.

3 RESULTS AND DISCUSSION

3.1 Study Area

Batang Kuranji watershed is one of the watersheds in Padang City which has an area of 202.7km², stretching from Pauh sub-district to North Padang sub-district and ending at the Indian Ocean.

The Kuranji River Basin originates in Sikai Mountain and covers the Lambung Bukit sub-district, Pauh sub-district. While the middle part of Batang Kuranji includes other sub-districts of Pauh sub-district and some sub-districts of Kuranji District. The downstream area covers part of Kuranji sub-district, Nanggalo sub-district and North Padang sub-district.

Based on the GIS analysis, the Batang Kuranji River Basin has a 202.70 km² watershed with the main river length of 32.41 km and the total length of the main river and other rivers within the watershed are 274,75 km, thus the drainage density of the Kuraanji River Basin reaches about 1.36 km/km². Batang Kuranji catchment area is a Bird Furtype with a very high gradient with 1.36/km river density with sub-watershed: Kuranji riverbed area is 19.86 km² with the main river length of 14.66 km, sub-

watershed Batang Belimbing 62.64km² with main river length 17.08 km, Batang Sungkai Sub-basin 6km² with main river length 3.63 km, Batang Janiah/Karuah-basin 82.26 km² with the length of 18,86 km, and Limau Manih sub-basin 31,93 km² with the main river length 16,42 km. The width of the river in the middle of the Kuranji basin averages 50- 80m with a depth of 2m-3 m. The downstream area of Kuranji basin has a width of 80m with an average water depth of 2m-3m.

Kuranji watershed is one of the existing river basins in the city of Padang that stretches from Bukit Barisan National Park to the District of North Padang. Kuranji River Basin is the largest watershed among several watersheds in the city of Padang. This makes the Kuranji watershed as one of the main water resources used for agricultural irrigation and clean water. Kuranji River Basin area is also made and important settlement for communities. The Batang Kuranji in Padang city was also chosen because it is one of the largest river basins in the four river basin in Padang City, which is the main source of water for agriculture and clean water for most of Padang's inhabitants.

In general, Kuranji watershed catchment area in the upstream area is still relatively good compared to other watersheds. However, in recent years, there have been floods in several areas along the Kuranji watershed, causing destruction of the sub-watershed of Limau Manih. Flash floods that hit the city of Padang several years ago caused much damage to the community and local government. The flooding incidents were also closely related to the decrease in land cover and high rainfall. In addition, differences in river flow altitude are also one of the causes.

There are several factors that cause flooding. These factors are natural conditions (geographical location of the region, ground conditions, river geometry and sedimentation), natural events (rainfall and duration of rain, tides, backflows from major rivers, river basin damming due to landslides, sedimentation and cold lava flows), and human activities in land-use changes that impact on catchment areas which then affect the conditions and changes in runoff changes (Irsyad & Ekaputra, 2015; Kerr, 2007).

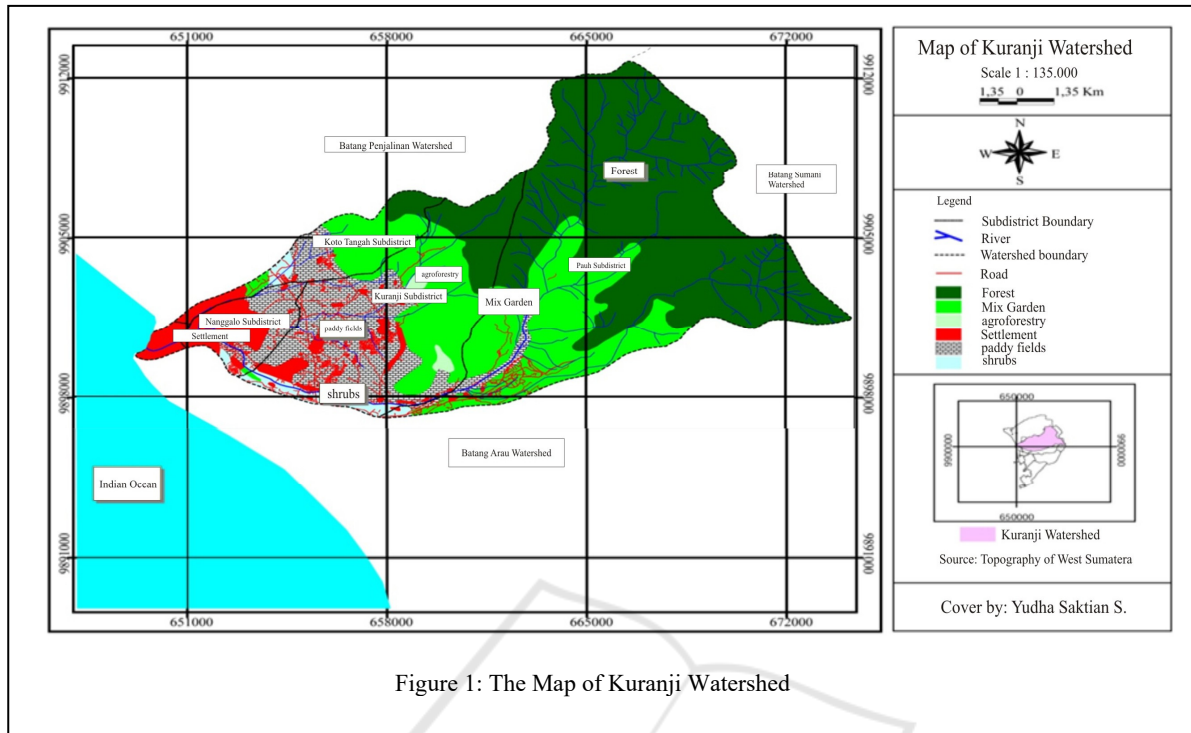


Figure 1: The Map of Kuranji Watershed

In addition, a very significant difference in height between the upstream, downstream and the middle if the upstream of the water flow increases can cause the downstream area to be flooded. These floods can cause landslides that occur in the upstream and downstream. Many community homes and other infrastructure can be damaged by disasters like these.

3.2 Public Perception on the Problems in the Upstream Area

The upstream area of the Kuranji watershed is located in the villages of Lambung Bukit, Pauh sub-district with a total area of 38.80 km². In this area there are still rice fields, dense forests and community settlements. In general, the social-economic condition of the people of Lambung Bukit village is the average livelihood as a farmer. The population only reaches 3,650 people with a population density of 94 people per km. The average temperature in this region ranges from 23-28°C, with an average rainfall of about 60.61 mm/month. The peak of the rainy season occurs between October and December. The recorded rainfall data from the Climate Station in Batu Busuk shows that the average annual rainfall in this basin is about 3,582 mm, and the highest in 2016 at about 4,549 mm.

Land use in highland watersheds is dominated by protected forests and community-owned mixed gardens (*parak*). These *parak* are generally grown by highlanders with hard crops as the second source of their income after rice farming and home gardens near their settlements, such as durian, petai, rambutan. Even in the last ten years, a number of community members have tried to cultivate cacao plants on the ground. Demographically, based on survey results of respondents, the average age of households living upstream about 45 years, where one-third of them (33%) have lived there since they were born. Approximately 36% of households are migrants from outside the upstream areas who move there after marriage. In general, nearly 50% of them have lived in this upstream area for more than 40 years. In the context of livelihood strategies for their daily life, 26.7% of HH (Households) have a high dependence on upstream farming, while 67% of HH rely on dryland and upland rice fields. Almost all households mentioned that they have durian trees and others such as petai and rambutan in their home gardens and *parak* near the house.

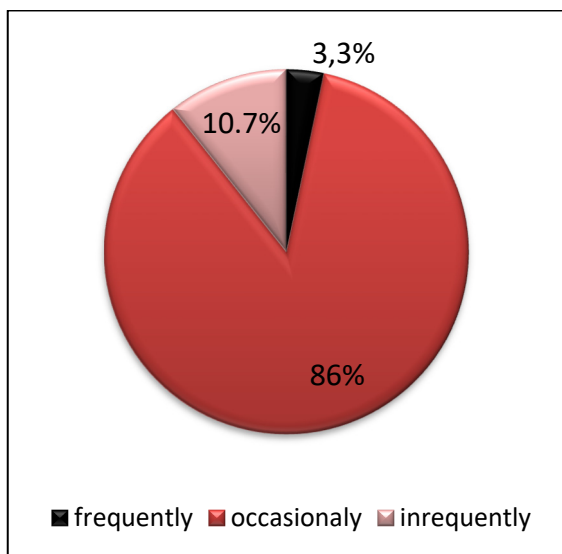


Figure 2: Perception of Respondent to the Frequency of Landslide.

The upstream Kuranji river catchment area is a protected forest area. Key informants from this study suspect that since forest cover degradation in upstream catchment areas has reduced, this has threatened the sustainability of their agricultural activities downstream. For the past 10 years, local residents have assumed that high rainfall in the upstream during the rainy season will cause erosion and flooding in their fields. They only feel safe to cultivate their fields in the dry season rather than the rainy season. The high flow of water rainfall that suddenly causes floods from the hills often resulting in landslides in several locations.

Based on a survey respondents, about 3.3% of respondents said landslides often occur around their residential location, 86% of them said the occurrence sometimes is not frequent, and the rest says it rarely happens (Figure 2). Key informants interviewed have also reinforced the problem of floods and landslides in this area. Accordingly, all this is closely related to the development of massive timber exploitation in the upper reaches in the 80-90s.

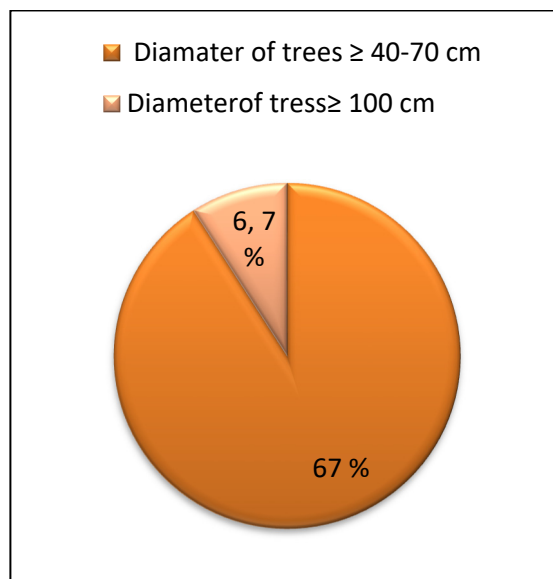


Figure 3: Knowledge of respondents about the availability of Commercial Timber in Upstream.

The majority of respondents (50%) stated that there is still considerable commercial timber available in protected forest areas (Figure 3). Furthermore, the majority of respondents (67%) also stated that timber trees that are still available in protected forests are mostly of a diameter of 40-70cm. Only 6.7% of respondents stated that there were still trees with diameters greater than 100cm.

Types of wood trees that exist in these forest areas are *bayur*, *mahony*, *kalek*, and *timbalun*. Currently, public awareness of land cover conditions in upstream areas is higher than before. the mix-garden (*parak*) has begun with the conception of agroforestry, where existing wood species are preserved or newly planted, such as *durian* and *petai*. The upstream area is one of the areas that needs conservation, one of them with reforestation to increase the ability to withstand runoff. A conservation area is a recommendation to reduce the risk of flood disaster and erosion is LimauManih, hillside, GunungSarik, Kuranji and LubukMinturun.

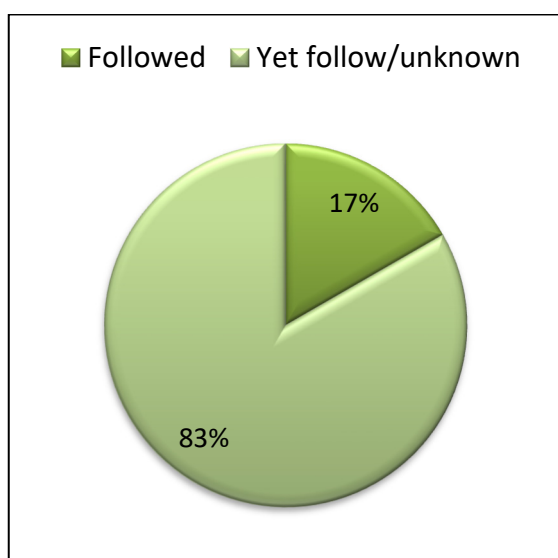


Figure 4: Community Participation at the Upstream Area on Community Forestry Training Group

The Community Forestry Group, established in 2016, will be the main platform for communities in the upstream watershed of Kuranji watershed to contribute to conserving forests, preventing illegal logging models while ensuring better local livelihoods. To date, only 16.7% of respondents have received training related to Community Forestry Group activities, 83.3% of respondents stated that they have not studied or even know much about the activities of this group (Figure 4).

In the new era there was a policy on a five-year development program (PELITA) in Indonesia that led to massive logging to convert forest areas into shifting cultivation areas. This is where the origin of common problems that occur in the upstream area that some people provide information that at the time of high rainfall 5 to 10 years later threatened paddy fields, thus threatening the livelihood of farmers who seek paddy field farming. It was delivered because the area of paddy fields adjacent to the upper river basin area Kuranji stems of the last few years are often submerged due to landslides.

In addition, the increasing rainfall that suddenly caused flash flooding from the hills. This makes the occurrence of erosion of mud accompanied by water from the slope of the hill in the upstream area of Batu Busuk village. As a result, the business of horticulture farms such as chilli was affected and damaged. Key informants mentioned that the upstream ecosystem in the protected forest area is still good but in the slopes a road is being built to connect the village on the hill, so it is that if there is high rainfall intensity it will be directly causing

floods that hit the upstream areas especially affected paddy fields and cultivated areas under the slope of the hill.

Then the problem that occurred from the issue of flash flood in 2012 is the average society still not care about the environment as it is throwing household waste into the rivers. So there is a blockage in the primary channels of the river flow from upstream to the middle and downstream areas.

3.3 Public Perception on the Problems in Themid-Stream Area

The central area of the Kuranji watershed is located along Kuranji sub-district where the river flow includes five villages namely Kuranji, Korong Gadang, Kalumbuk, Laweh and Surau Gadang, Gurun Laweh. Types of livelihoods are farmers to employees.

3.3.1 Public Activities

The middlestream area of the Kuranji watershed is a vital area in the management of Kuranji watershed and for maintaining the ecosystem balance of the Kuranji watershed. Community activities that utilize the central area watershed will have an impact on the community in its middle and downstream areas. Various kinds of community activities are in the middle of watersheds identified are agriculture, illegal logging, factory industry, land clearing for housing and sand mining into activities that affect the balance of watershed ecosystems.

The middle section is mainly planted with paddy fields 2-2,5 times in a year. Agricultural activities are mostly done in Surau Gadang and Laweh Gurun. Farmers in these two regions simultaneously plant paddy field to ensure all farmers obtain the water equally through regulations established by Farmers Water User (*Perkumpulan Petani Pengguna Air/P3A*). The land in both urban villages is difficult to be planted horticulture commodities. This is because when rains are heavy it is difficult to dispose of excess water in their farms. Relatively flat topography, land use and poor drainage are the main causes of this. This has worsened the condition of the middle zone, especially agricultural activities that require a lot of water at the beginning of the planting period. Industry plant built in the middle of adding a series of existing activities. Construction of factories that began with the reasons to build a pond has now continued and changed with the drinking water industry. The development of the factory industry will obviously add to the problems that

occur in the middle of the watershed. This is proven by changes in water quality in the middle of Kuranji watershed.

Other activities include land conversion for illegal housing and mining of sand. Land clearing created new problems that further aggravate the condition of water quality flowing through the middle of Kuranji watershed. According to the responder's statement, the quality of water flowing through the Kuranji watershed after the housing construction can no longer be used directly for bathing or washing the face. This is because the colour and smell of water has changed, it was not as clear as before.

3.3.2 Problems in the Middle-Stream Area

Heterogeneity of activities and interest in the middle of Kuranji River Basin certainly causes obstacles for both environment and society. These include changes in the quality and quantity of water resources, making accusations between upstream and central areas, rivers and irrigation networks as dump trucks, mutual cooperation in the maintenance of irrigation networks began to fade, unfair water distribution, irrigation network conditions, which is not yet environmentally friendly, there was no integration of water resource utilization and disaster mitigation system and the land use change into residential areas.

The quality of water resources flowing down the middle of Kuranji watershed progressively decreases. This is evident from the change of colour and its smell - the water that flows through the middle of this region is black and has an unpleasant smell. While from the side of quantity, the water that flows the middle area of Kuranji watershed is used for many fields and wells of citizen.

The Kuranji watershed as a source of water for household and agricultural needs is unable to meet that need again today. Increasingly reduced water supply for agriculture and unfavourable water quality flowing into the paddy fields makes this a problem that must be solved.

In addition to water resources problems that must be solved, also other problems arising due to rivers and irrigation networks as garbage dumps. These problems cause a sustainable impact on the environment and socioeconomic communities. Waste discharged into rivers and irrigation networks will lead to accumulation of waste in the upstream to downstream areas. So some of the garbage carried will be a source of disaster for the people in the middle and downstream more mainstream adding by

industry waste activities. So this raises a new problem for the community that is the conflict of mutual accusation between society.

3.4 Public Perception on the Problems in the Downstream Area

The downstream area of the Kuranji watershed area located in the district of Padang Utara. This area is generally crowded by residential and commercial areas. The total area is 1.12 Km². For its own downstream area on its right is the West Air Tawar village. As the livelihood of the average citizen is the trader.

The downstream part of the Kuranji watershed starts from the back of the Basko Hotel towards the estuary of the sea. Throughout this region, a "canal flood" has been built to anticipate flooding which has resulted in the erosion of the river bank. In addition, there are two connecting bridges and one Train Bridge. On the edge of the canal river there are residential areas and also various kinds of human activities.

The conditions in this section are strongly influenced by human activities. Water colour changes that occur in downstream hence can know the quality of water flowing from upstream to downstream. Where the water that flows down to downstream is no longer as clear as water upstream. The colour of blackened water more dominates. Meanwhile, the water will meet directly at the sea.

In the downstream area of the Kuranji watershed no longer exists mangrove forest. In addition, this area also does not have agricultural land as in the middle and upstream areas. The average community livelihoods in this area are as fishermen and traders.

The more diverse community activities downstream area of this Kuranji watershed is added environmental problems and social communities increased. Some problems arising from the various activities that occur in the downstream area of Kuranji watersheds such as floods, waste piles, fish catch decreased, loss of mangrove forest area, sedimentation of Kuranji watershed, a damage to the Kuranji watershed area every year, and the absence of river basin management mechanism. Flood disasters are a problem occurring almost every year in the downstream area of Kuranji watershed. A large water discharge during the unstoppable rainy season will directly inundate most of the downstream area. The rising sea level that coincides with the arrival of water from upstream and central areas further exacerbates this situation. Since the great flood in 1989, the city government tried to find

help to overcome the problem. So finally in 1990 the canalization of watersheds from Japan for the entire river area in West Sumatera. Until now the floods in the downstream region always occur every year but not as severe as previous years.

The Floods which occurred each year is reaching 4 meters to meet the flood canals that have been made. At the time of this research survey conducted high water level that seemed to meet $\frac{3}{4}$ part of the canal flood that has been built. It is suspected that the flood problem occurring in every year is not only caused by community activities in upstream areas but also in the middle and downstream areas. Large water flows and floods that occur every year not only harm the community. Large direct water currents will also carry sand or soil particles from upstream to downstream. the dam function did not work properly barrier rock or wood forest that flowing from upstream. If this process occurs continuously will appear deposition of sand or soil called sedimentation.

Some community members in the downstream section work as fishermen. Their catch was more when pre-construction of canal flood because fish and another marine biota still often appeared in the watershed area. The problem today felt difference by the fishermen after the river basin development is the difficulty of getting enough catches to meet the economic needs of the fishing communities. This is causing some fishermen to switch their livelihoods. Many of fishermen have to catch fish in the ocean area further away from the downstream area of this Kuranji watershed. This is different compared to before the canal was built when fishermen could catch the fish in the watershed area alone without having to go to sea.

The development of a flood canal project that aims to reduce the risk of floods received by the community requires clearing land in the downstream area of the Kuranji watershed. So that causes some of the mangrove forest area downstream area is cut down. The loss of part of the mangrove forest area in this area causes the balance of the downstream ecosystem downstream. Some marine organisms that live in symbiosis with mangroves or mangrove trees to be moved to choose an area that suits their required habitat. This lost mangrove forest area needs to be the government's attention.

Complicated problems in the downstream area of this Kuranji watershed. ranging from floods, garbage, and sedimentation and also more worrying to some people in this area is the degradation of land that they occupy today. This is felt by the people who live near the canals. The respondents said that

almost every year the surface of this land dropped approximately 2 - 4 cm. They felt a deeper gap was forming downstream at the end near the sea area. This is a concern for some people. However, there has been no special attention from the local government.

The problems along the river basin are holistic, multi-functionality of river basin, a different interest that encourages conflict, all parties needed to manage conflict, uncertainty alternative and result because of disregard the decision process, the meaning is law not beyond criticism (Mostert, 1999).

Watershed management is needed for the realization of clean and safe river basins. The current problem that is felt by some people in the downstream area of Kuranji watershed is the absence of comprehensive watershed management. So this creates new problems that keep popping up in the downstream area. For example, currently, the water flowing downstream is black and brown. this proves that in the upstream and central areas and some downstream areas still occur waste disposal in randomly to the city either household waste or industry. This waste disposal is not yet well-managed. So this causes losses in the downstream community.

Problems that occur in downstream areas Kuranji watershed needs to be a concern for the community and government and the private sector. In the conditions that occur as now, it is supposed to downstream part of this Kuranji watershed done improvements both physical buildings and governance. But it is very unfortunate. Until now the city government of Padang itself has not done much for this area. It is required that the rules are comprehensive and capable of coordinating all parties involved in handling the Kuranji river basin as common pool resource. Regarding resolving water damage, synergy is needed between regions in the form of role-sharing between the Province, district sub-district, and or villages at upstream and downstream areas. Integrated watershed management should keep attention to the relationship between a sector with the activities sector to water supply because its component will affect the other sectors (Handayani, 2013).

Various methods can be applied to conflict resolution efforts in river basin basins, especially as irrigation problems can be solved by analytic hierarchical model. The model is utilized along the river by involving the farmers on data assessment (Febriamansyah, 2006). Furthermore, for conflicts resolution that involving many parties, it is

necessary to do various stages of compromise to reach an agreement whereby one party receives compensation for the achievement of conflict resolution. integrative conflict among conflicting users by adding mediator roles. The resolution of conflicts within the natural resources in Indonesia could through mediation, reconciliation and negotiation, which then establishes a communication forum in resolving disputes and or through arbitration if necessary (IWRM, 2018). No optimization participatory approach based on the IWRM and Dublin principle concept on river basin Kuranji issues becomes the preliminary information for decision makers to better maturing the rules and utilize platform and forums active in dealing with water resources issues. Water resources have become common pool resources so many parties are involved and the challenges faced become more complex. collective action among users are needed in the watershed system (Kerr, 2007).

4 CONCLUSION

Too late people realize water resources are a shared resource and by that time the problems are mounting. The current impact is still a lack of understanding of the public that water is to be an integral part of nature which is not separate within a single system. This is evident in the case of river basin water users against the problems faced today. There are parties involved and pollute and destroy the environment has not been dealt with firmly. To be concluded that the management of water resources Kuranji is not in accordance with the principles of water use agreed to the world. the emphasis in participatory approaches has not been met as seen from the inadequacy of forums that bridge the problems faced by the community to be acted upon immediately by decision makers.

In addition, we need to strengthen legal enforcement that binding to IWRM concept at basic level to general level. On the other hand, integrated management with experts to apply the rules and find conflict resolution form some insight by scientist, policy makers, users and the public is to be a requirement.

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