

CROSS-BORDER FLOOD MANAGEMENT IN BENGAWAN SOLO HULU WATERSHED

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ABSTRACT

Cross-border floods are not only cross-country and cross-province floods but also include cross-district/city floods. The flood that occurred in Sukoharjo Regency was a cross-border flood (cross-border flood) covering four upstream districts, namely Boyolali, Klaten, Wonogiri and Karanganyar Regencies. The management needed concerning cross-border flooding is the handling of integrated cross-border synergies that enter the Watershed (DAS) with countermeasures, not only structural but non-structural, and involving all stakeholders. This study uses a combination of spatial science and critical human geography paradigms so that the appropriate research design is a mixed method, namely research with both quantitative and qualitative techniques. The critical human geography paradigm is also used here in conjunction with the political ecology approach in tracing the increased risk of flood disasters associated with an expanded urbanization process, an approach derived from production space theory. The results of this study show that the integration of disaster management between regions is very important, both upstream and downstream. Human activities in the upstream region greatly affect the downstream region.

Keywords: , *Bengawan Solo; Disaster; Flood; Watershed.*

INTRODUCTION

Cross-border floods are not only cross-country (Timmerman et al., 2017; van Doorn-Hoekveld, 2017), and cross-provincial (Soemari et al., 2020) floods but also include cross-district/city floods. The flood in Sukoharjo Regency was a transboundary flood covering four upstream regencies, namely Boyolali, Klaten, Wonogiri and Karanganyar Regencies. The required management pattern, as stated by Booth et al. (Booth

& Patt, 2018), is a synergy of integrated handling of cross-border areas that enter the Watershed (DAS) with broader mitigation efforts (not only structural mitigation) and involves all stakeholders. Even though there has long been talking of cooperation across districts/cities in Solo Raya, which is often called Subosukowonosraten (Surakarta, Boyolali, Sukoharjo, Wonogiri, Sragen, and Klaten) in development management



and spatial planning, including flood management, its implementation is "still deadlocked". Researchers offer the development of a disaster risk trading system in cross-border flood management (risk trading in transboundary flood management) which Chang previously introduced and Leentvaar (C.-T. Chang & Leentvaar, 2008; C. T. Chang, 2017). In this study, the implementation of risk trading is not only financial, but is expanded with social capital and institutions, a new concept which is the development of the concept of social capital (D. Maulidatuz, I. Rini, R. Alfiah, 2016; Dasgupta, 2015; Kusbiantoroa, 2016; N. Parlinah, B. Nugroho, M. B. Saleh, 2018) and watersheds.

Chang (C. T. Chang, 2017) introduced a flood mitigation market with traded flood mitigation permit transactions (Tradeable Flood Mitigation Permit, abbreviated as TFMP). TFMP offers a new perspective for inter-regional collaboration by providing a means for exchanging resources between upstream and downstream areas. The consideration is that TFMP is very closely related to flood management and spatial planning. Land use activities in the upstream watershed area will have

both beneficial and detrimental effects on the downstream areas by reducing or increasing the risk of flooding. The construction of reservoirs in the upstream area will reduce the risk of flooding in the downstream area, whereas the addition of extended urbanization and environmental destruction (Gorelick et al., 2017) in the upstream area will increase the risk of flooding in the downstream area. In the first case, the downstream area pays the upstream area, whereas in the second case, the downstream area receives payment from the upstream area. The concept of reciprocal risk trading uses the principle of internalizing externalities using direct financial means (C. T. Chang, 2017). Ecotourism programs, making infiltration wells, bio pores and tree planting are driving infiltration. The purpose of this study is to show how changes in land use in the upper reaches of the river greatly affect flooding in the downstream areas. So that disaster management through the implementation of disaster trading is a very appropriate solution.

MATERIALS AND METHODS

This study uses a combination of spatial science and critical human geography



paradigms, so the appropriate research design is a qualitative technique. The critical human geography paradigm is also used here in relation to the political ecology approach in tracing the increased risk of flood disasters associated with the process of extended urbanization, an approach derived from the theory of spatial production. The theory of space production is a further development of Karl Marx's circuit theory of capital which does not only focus on the factory but develops into space and space to become the second capital circuit (Boyle, 2017).

RESULTS AND DISCUSSION

Management of cross-border flooding has been carried out by many previous researchers, such as Chang and Leentvaar (C.-T. Chang & Leentvaar, 2008), van Doorn-Hoekveld (van Doorn-Hoekveld, 2017) and Soemari (Soemari et al., 2020). The first three studies are related to cross-border flood management, while the fourth research is related to cross-provincial flood management. This research is different from previous studies because it focuses more on research in the Upper Solo Bengawan Sub-watershed, which involves flood management across

district boundaries, namely Boyolali, Klaten, Wonogiri, Karanganyar, and Sukoharjo Regencies. The first four regencies are located in the upstream watershed, while the last 1 district is located in the downstream watershed.

Chang and Leentvaar's disaster risk trading approach (C.-T. Chang & Leentvaar, 2008) and Chang (C. T. Chang, 2017) operationalize the trade concept through modelling incentives and disincentives between upstream and downstream (El-Naqa & Jaber, 2018) and identification and evaluation of spatial and temporal changes in land use based on big geospatial data as indicators of increased risk flooding due to extended urbanization.

Extended Urbanization

The process of urbanization triggers a process and internal and external spatial development of the city. The spatial development of these urban concentrations also has implications for a process of transforming rural areas into urban areas, both on the outskirts and expansion of existing urban areas as well as in other areas that trigger the emergence and development of new urban areas, both in the context of the



physical, social and economic environment (Kundzewicz et al., 2018). The Karanganyar Regency area, especially the Tawangmangu District, is very massive in the urbanization process. The urbanization process is often driven by the gentrification process. The findings related to the gentrification phenomenon are based on the identification of gentrification characteristics. According to Prayoga (Tri Prayoga, 2013) that the characteristics of gentrification include changes/shifts in population, social change, segregation, and regional revitalization within a society. The factor

that causes gentrification in Tawangmangu District to take place quickly is tourism. According to Gotham, (Gotham, 2013) Tourism Gentrification refers to the transformation of the middle-class environment into a space marked by the mushrooming of various entertainment companies and tourism places. Even though the Tawangmangu District is a catchment area, if the change of land from green open land to built-up land continues to experience conversion, it will exacerbate the flood disaster downstream (**Figure 1**).



Figure 1. The Extended Urbanization Process in the Upstream Bengawan Solo Watershed

Structural and non-structural Flood Management

The relationship between upstream and downstream areas requires a concept of planning and managing watersheds guided by one river, one planning and

one management (Sneddon & Fox, 2006; Sudmeier-Rieux et al., 2015). Regions included in a watershed do not only pursue Regional Own Revenue but must think about the common interest so that the continuity of the watershed function



is optimal and sustainable. Although there has long been a discourse of cooperation across districts/cities in Solo Raya, which is often called Subosukowonosraten (Surakarta, Boyolali, Sukoharjo, Wonogiri, Sragen, and Klaten) therefore, there is a need for coordination between regions within one watershed area.

The management of the upstream area is the local government's responsibility, but the responsibility of all areas within the Bengawan Solo watershed area. Considering the good and inadequate management of the upstream area, the impact of which will be felt by all those in the watershed area, the thought arises of the need for compensation for the

downstream area for the upstream area. Furthermore, what compensation should be given to run the program requires coordination and sitting together in management planning, followed by all regions in the Bengawan Solo watershed area and the Bengawan Solo River Basin Center (BBWS).

Structural efforts through the physical construction of infrastructure such as dams and ponds must be complemented by non-structural activities to increase public awareness and all stakeholders to reduce the risk of flood disasters. In addition to being a tool for storing water and flowing agricultural land, dams also function as a structural flood management function (**Figure 2**).



Figure 2. Gajah Mungkur Reservoir

Incentives and Disincentives

The mechanism for trading disaster risk between upstream and downstream is not easy. It is necessary to create institutions

that can overshadow the problems that arise. Indeed, in the upstream areas that do not carry out conservation and change the land use from green open land to



built-up land, financial disincentives must be given through a tax payment system that must be paid every year. It is a different matter if the upstream area carries out land conservation and programs capable of managing floods so that floods do not occur in the downstream areas; it is necessary to obtain incentives for the programs implemented by the region. This is similar to what has been carried out by Wonogiri Regency, which built the Gajah Mungkur Dam.

CONCLUSIONS

Management of cross-border floods is one of the breakthroughs in conventional flood management without integration between administrative areas. This article is different because it focuses more on research in the Upstream Bengawan Solo watershed, which involves flood management across district boundaries, namely Boyolali, Klaten, Wonogiri, Karanganyar, and Sukoharjo Regencies. The first four regencies are located in the upstream watershed, while the last 1 district is located in the downstream watershed where the downstream area gets an impact due to area management that is

not in accordance with its designation in the upstream area.

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