Problems and Challenges in Sustaining Rural Land Resources

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Abstract. The discussion in this paper brings up issues on how the land resources utilization is done mainly as a respond to socioeconomic development instead of achieving sustainability. Delanggu sub-district of Klaten Regency and Kledung sub-district of Temanggung Regency were chosen as the study areas. We collected data and information by conducting Focus Group Discussion in each study area with relevant stakeholders and analysed the issues further using SWOT and problem analysis approach. The result showed that even though land use change is a common issue shared by both study areas, the drivers as well as the approaches taken by the community and stakeholders from each sub-district are different. Kledung sub-district as a rural mountain area appears more sustainable in term of land resource utilization than urbanized Delanggu sub-district which is a plain area. The findings call more challenges for future adaptive approaches to answer the notion of sustainable agriculture in rural area.

Keywords: rural resources, land use, land resource utilization

1. Introduction

Rural areas have a great diversification in terms of physical environment, ecology, and pattern of land use as well as their socioeconomic characteristics [1],[1], although it is common to find that agricultural activities are where the big part of its community’s income share is generated from. However, the increasing agricultural activities in rural areas has caused direct and indirect impacts on the decreasing rural resources. Several key issues at regional level that threaten the existence of natural resources include land degradation, water availability, and loss of biodiversity [3]. At the local level, the problems that arise around rural area’s agricultural activities are shown through the socioeconomic impacts on its community. From time to time farmers’ families are constantly adapting to the stresses on environment and socioeconomics conditions that influence the existence and availability of natural resources and biodiversity [4].

Many rural areas in Indonesia, especially on Java, have experienced a transition process in a long period of time that was determined and influenced by the activities of their rural communities [5]. This long transition process has helped shape the pattern of rural resource utilization. Resources in rural contexts are mostly used as inputs for agricultural production and closely related to environmental conditions. With such context, agricultural activity is considered an effort in managing interactions between resources and environment for output optimization [6]. Resource utilization in the rural area indicates the relationship between economic and environmental aspect. Income gain by the farming family represents the economic aspect while land resource utilization represents the environmental aspect. Farming families are the main player between those two aspects where the decision on how to
utilize the resource very much depends on the family [7], [8]. While resources like land, water, and human resources are vital for the agricultural activities, the practice of the activities by rural communities are also resulted in the unsustainability of both resources and agricultural activities. This dynamic can then be seen through the shift of land use practice as well as the socioeconomic conditions of the rural communities.

1.1 Study Area
Two different rural areas were selected for this study to show how the community characteristics in each rural area affect the land use and resource utilization practices. Delanggu sub-district (100-200 meter above sea level) in Klaten Regency will be discussed to represent plain rural area and Kledung sub-district (1100-1500 meter above sea level) in Temanggung Regency for mountainous rural area. Based on the community socioeconomic characteristic and agricultural activities in both areas, we seek a deeper understanding about issues faced by the community through focus group discussion (FGD) that involves all the village head and sub-district head. The discussions bring up issues on why most spatial planning in rural areas happens as a respond of socioeconomic development instead of achieving sustainability of rural resources. In this paper we analyze the issues further by implementing problem tree and SWOT approaches which aim to get more rounded understanding on how land use and resources utilization practice in rural areas are both affecting to and affected by the socioeconomic characteristics of the rural community.

2. Methods
In achieving the objectives of the study, the research team has conducted focus group discussions (FGDs). The FGDs are meant to collect information and perceptions of the stakeholders regarding the sustainability of resources and biodiversity in village spatial planning. The discussion also provides how the stakeholders handle problems around land use and resources utilization and what their strategic decisions on the matter implicates the overall practice of rural spatial planning in the study areas. The analysis tools used are problem trees and the SWOT analysis. Problem tree analysis helps to map issues and its causes as well as effects so that it is easier to form solutions for the problem [9]. Developed by Humprey [10], SWOT (Strength-Weakness-Opportunity-Threat) is an analytical tool to find the best strategy in decision making based on internal strengths and weaknesses as well as opportunities and challenges which comes from external factors. By identifying internal strength and weaknesses as well as external opportunities and threats, this instrument provides a simple approach to assess the best way of implementing a strategy [9]. By using these two analysis tools, the writer needs to breakdown the situations faced by rural community that mostly still has to depend on agricultural activities despite land use issues and decreasing quality of supporting resources.

3. Results and Discussions
3.1 Socioeconomic Characteristic and Land Use Change
Rural areas with dominant agricultural activities as its community livelihood generally have agricultural land owned by the farming families that are located nearby their settlement areas. It is common to find most of their houses located next to their farming or paddy fields. Even though both Delanggu sub-district and Kledung sub-district are rural areas, family income composition shows a different trend that may lead to the difference on each socioeconomic characteristic. As seen in Table 1, family income in Kledung sub-district dominantly makes up from 96% farm income and only 4% from off-farm income. Meanwhile, Delanggu sub-district has its community more dependent on off-farm income as it makes up 61% of the family income in the sub-district whereas farm income has 39% share. Such result can come from the condition that Delanggu sub-district which is a plain area located near the urban area of Solo City. On the other hand, Kledung sub-district is far from any city given its location in mountainous area hence more dependent on farming. This indicates that based on their economic activities, the
The community in Delanggu sub-district is more likely to have an urbanized characteristic than the community in Kledung sub-district.

Table 1. Composition of Family Income\textsuperscript{a}.

| Sub-District | Area Type              | Composition |
|--------------|------------------------|-------------|
|              | Farm income            | Off-farm income |
| Delanggu     | Urbanized Rural Area   | 39%         | 61%         |
| Kledung      | Mountainous Rural Area | 96%         | 4%          |

\textsuperscript{a} Rudiarto et. al., 2018.

The socioeconomic condition is also supported by the land use change in both study areas over the last 15 years from 2000 to 2015. As shown on Figure 1, yellow area that represents settlement and built areas area growing in both Delanggu sub-district and Kledung sub-district. However, the change is apparent in Delanggu sub-district where settlement and built areas are growing vastly to most of the sub-district. The maps show how these yellow areas come in substitute of green areas that represent agricultural lands such as farm fields and paddy fields. Whereas in Kledung sub-district the growth of yellow areas are not significant and only concentrated along the main road. As it is geographically located between two mountains, Mount Sumbing and Mount Sindoro, the major parts of Kledung sub-district are sloping areas that is not only relatively harder to develop but also is part of protected forest area. It can be seen on the Figure 1 that farm fields and irrigated fields are still dominant as it grows nearing the part of shrubs area on the mountainsides of Mount Sumbing and Mount Sindoro.

![Figure 1. Land Use Change in Study Areas from 2000 to 2015.](image-url)
The existence of settlements in rural area is central as it may reveal the relationships between land and the community [11] [12]. Generally, rural settlements are in high pressure of the urbanization and have been significantly transformed into a more urbanized area [13]. According to the measurement of land use cover change from landsat maps of year 2000 and 2015, Delanggu sub-district has a surging of settlement and built areas up to 61.11 ha while agricultural lands and grass have decreased as much as 60.17 ha and 0.94 ha respectively. The number shows that the decreasing green areas happened to accommodate more development of settlement and built areas. The same thing also happens in Kledung sub-district where the agricultural lands have decreased by 24.39 ha. Unlike in Delanggu sub-district, the decreasing agricultural lands in Kledung sub-district is not only a shift to settlement and built areas (20.88 ha) but also to grass (3.51 ha). It indicates that some agricultural lands are gone neglected or unproductive hence the size of grass areas is increased. The land use portion of settlement and built areas in Delanggu sub-district is 27% of the total area while in Kledung sub-district it is only 6%. The difference on the settlement and built areas size once again shows that Delanggu sub-district is becoming an urbanized area while Kledung sub-district still preserves its rural characteristic.

3.2 Problems of Land Resource Utilization
As has been discussed on the previous section, land conversion is one common issue that is present in both sub-districts. On the one hand, land use shift to more built areas can indicate a positive development in rural areas where the community is benefited socially and economically. On the other hand, if the land use changes disrupt the previously established way of life of the farming community, the adjustment made could detrimentally affect how rural resources such as land, water, and human resource are utilized. Here, through SWOT analysis as presented in Table 2, we look closer to how the changes in land use are at the centre of the problems surrounding utilization of land as an integral resource for agricultural activities in Delanggu sub-district and Kledung sub-district.

3.2.1 Delanggu sub-district
According to Bappeda of Klaten Regency [14], Delanggu sub-district is planned to be one of the urban activity centres in the region. It is a local activity centre that serves regional scale activities that include trade and service, urban settlements, agriculture, and industry among others. Delanggu sub-district is also allotted for agricultural food crops and horticultural production centre, especially paddy. The average land area managed by the community is 0.54 ha per household with an average yield of 11.2 tons per ha per year [8]. Although most of the land in Delanggu sub-district is utilized as paddy fields, the land along its main road are now converted to built areas for settlements and business.

Based on the results of focus group discussion (FGD) with the heads of 16 villages in Delanggu sub-district, the conversion of paddy fields is increasingly prevalent over the past decade. Many land conversion cases are done without legal permit as there is also incongruity between practices and the spatial planning regulation. Land that is supposed to be green areas could be made available for development or are re-planned to accommodate market demand over land. At the same time, the village administration also does not hold any authority to hinder land owners that choose to sell their land to developers or build it into another house.

Aside from the regulation issue on spatial planning, economic motives are in the heart of the problems surrounding land conversion in Delanggu sub-district. Over the years, the community finds that productivity of their paddy fields are decreasing significantly with the production cost greater than their earnings from it. Some factors such as planthopper pests, decreasing irrigation water - mainly from Cokro springs, and low quality of the seeds come into play in this issue. As the farming community no longer can rely on their livelihood in the agricultural activities alone, they end up looking for more reliable income options outside of farming.

Adding urbanization, which is already present in the community, to the situation, it is then inevitable to see a declining trend of the community participation in agricultural activities. Younger generation prefer to work in service or industry sectors while the older ones can no longer handle the works needed in farming. The results are the ever decreasing productivity and inclination to give up agricultural
activities. Both effects perpetuate more land conversion as selling or developing their land to meet their financial needs has more cost effective than keeping it as farming field. However, in 2018 national government through Ministry of Agriculture has already initiated a development program in which the farming community in Delanggu sub-district is given seeds of new paddy variety that can be harvested four times a year. It aims not only to boost the productivity of the community’s agricultural activities but also as an effort to slow down the land conversion.

Table 2. SWOT Analysis of the Land Resources in Delanggu and Kledung.

| Strength | Weakness | Opportunity | Threat |
|----------|----------|-------------|--------|
| Delanggu | 1. one of the centers of urban activities in the region | 1. high conversion of irrigated land/paddy fields to settlements and business | 1. provision of new paddy variety that can be harvested four times a year is already on going |
| | 2. one of the center of food crop agriculture in the region | 2. declining community's participation in agricultural activities | 2. incongruity between practice and spatial planning regulation |
| | 3. 72% of its total area are agricultural land | 3. low work force in agricultural works | 3. decreasing availability of irrigated water from Cokro springs due to bottled water industry |
| | 4. declining productivity of agricultural sector | | 4. urbanization |
| | | | |
| Kledung | 1. highland with potential to be developed as agropolitan | 1. sloping areas prone to erosion and landslide | 1. high demand of land from developers |
| | 2. one of the centers of tobacco production in the region | 2. agricultural land conversion | 1. uncertain climate and season |
| | 3. abundant availability of water | 3. decreasing soil fertility | 2. low price of tobacco |
| | | 4. declining production of tobacco | |
| | | 5. poor access infrastructure | |

3.2.2 Kledung sub-district Situated on a highland, Kledung sub-district is potential for agropolitan and ecotourism. Kledung valley is one of the main catchment areas around Mount Sumbing and Mount Sindoro, hence most of its land use is green area. There are three springs: Si Gandul springs, Sidandang springs, and Tuk Sewu springs, for their main source of clean water and irrigation. This mountainous land has moderate potential to erosion and is prone to landslide. Conservation is done to reduce the risk of erosion and landslide by providing hedgerows and the application of terrace systems on the community’s farm land. Most irrigation systems used in agricultural activities are non-technical and rain-fed. Rainy season becomes a big challenge for the agricultural activities in Kledung sub-district as water inundating the farm land while the commodity are the types that does not need a lot of water.

The farming community in Kledung sub-district manage an average land of 1.15 ha per household with an average yield of 9.8 tons per ha per year [8]. The main agricultural commodities are tobacco,
garlic, onions red, chili, coffee, paddy, corn, and cabbage. In general, there was a decrease in agricultural production in Kledung sub-district for the last 15 years with tobacco being the commodity with the highest declining number of production. This declining production is caused by several issues but mainly because the uncertain climate conditions make it difficult to maintain the ideal environment for tobacco cultivation. Failure in harvesting could reach up to 50% in a year and this drives some farmers to stop farming all together and prefer to sell their land as a way to save them from financial crisis.

The decline in tobacco production and the inability to maintain the quality of crop yields make the selling price of tobacco become very low and uncertain. Tobacco farmers in Kledung Sub-district are then looking for a solution by implementing intercropping and crop rotation with other commodities such as coffee and vegetables. Some others even switch to other commodities with a lower risk of loss than tobacco. Nevertheless, there are also many farmers who have not made any efforts to increase their land productivity as the big part of the community by considering their farm production is already enough to help meet their family needs.

Another challenge related to land resources in Kledung sub-district is high erosion that causes decreasing land fertility. A lot of farm lands are on nearly 90 degrees slope area so its layers of soil are easily carried away by the flow of water when raining. Many farmers then use chemical herbicide to prepare their land for every planting cycle so that it reaches certain fertile conditions. Even though it is done to increase soil fertility, continuous use of chemicals actually further reduces soil fertility on the long run. The process of preparing their land without using herbicides is actually possible, however it requires them more cost as well as to do extensive plowing while nowadays it is increasingly difficult to find human resource for the work. It is also not to mention that the process of land plowing is already hard enough with the poor access infrastructure for the topography condition of most Kledung sub-district areas.

3.3 Formulating Problems and Challenges
Discussion on the problems of land resources in Delanggu sub-district and Kledung sub-district helps to see how even though land conversion issue is present in both areas, the drivers of land use change as well as the approaches taken by the community and stakeholders from each sub-district are different. Figure 2 sums up the main threats for the land resources in both sub-district and the current approach each has in facing the problems.

![Figure 2. Sustainability Problems of Land Resources in Delanggu and Kledung.](image_url)

Kledung sub-district with the lower level of land conversion and more manageable problems has a higher chance to keep its land resource sustainability. On the other hand, Delanggu sub-district problems are inevitable as the result of urbanization that seem to drive its local development. The community alone cannot do much change when the needed intervention on spatial planning is neglected by the authority, which in this case is regional government.
4. Conclusion

The study shows that even though land use change is a common issue shared by both study areas, the drivers as well as the approaches taken by the community and stakeholders from each sub-district are different. The sustainability level of rural land resource decrease in accordance to the development of its surrounding area when the needs of land for non-agricultural activities grow rapidly. Land use shift to more built areas is benefitted socially and economically even though at the same time such disruption to an established way of life of the farming community can detrimentally affect how rural resources, especially land resource, are utilized. Kleudung sub-district as a rural mountain area appears more sustainable in term of land resource utilization than urbanized Delanggu sub-district which is a plain area. The two findings call more challenges for future adaptive approaches to answer the notion of sustainable agriculture in rural area.

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