

Analysis of Subak Landuse Change Due to Tourism Accomodation Development in North Kuta Sub-district, Badung Regency, Indonesia.

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Abstract. Subak is a traditional irrigation management system in Bali which governs the distribution of irrigation water into rice fields. The problems that occur in Subak in North Kuta Subdistrict is the high landuse change of rice field due to the rapid development of tourism and in the Region Spatial Plan is mostly designated as land for non agriculture. The aim of the research is to find out the Subak landuse change into tourism accommodation during the last five years, as well as knowing the area of Subak which located in the area of agricultural lands food crops related to landuse planning regulation of Badung Regency. The research methods included analysis of satellite imagery, literature studies, field survey, analysis of Subak landuse change, analysis of the subak in the area of the agricultural land food crop.

Subak landuse change into non rice fields in the North of Kuta as much as 538.88 ha during the last five years. The change of rice fields into tourist accommodation as much as 92 accommodation. Subak which is within the area of farmland of food crops 548.35 ha and outside the area of farmland 459.04ha.

Keywords: Subak, landuse change, tourism accommodation, landfarm area.

1. Introduction

Subak is an organization farmers to management irrigation water that has a particular land area or have a source of water, have autonomous and Subak Temple. According to Regulation of Bali Province No. 2 the year 1972, irrigation system of Subak, defined as customary law society which has the characteristics of an agricultural-socio-religious, which is a gathering of farmers who manage their irrigation water in rice fields. The Council of the UNESCO in Russia at the end of June 2012 decided that organizations subak was accepted as World Cultural Heritage. Subak system different from other World Cultural Heritage because it is based on a concept or philosophy of Tri Hita Karana (THK) who has a meaning that is three-way to the happiness of life, consists of *parhyangan* (the harmonious relationship between man and God), *palemahan* (the harmonious relationship between man and natural environment) and *pawongan* (the harmonious relationship between human to human) [11].



Therefore the existence of Subak should be maintained and conserved. The existence of subak in North Kuta Sub-district are currently declining due to development of tourism.

North Kuta has total of 19 subak scattered in six villages namely Kerobokan as much one Subak, Kerobokan Kaja as much as two Subak, Kerobokan Kelod three Subak, Canggalu four Subak Tibubeneng six subak, and three Subaks in Dalung. Subak landuse change is due to the development of tourism which provide a great influence towards landuse in North Kuta. Land for construction, tourism, infrastructure and other economic areas are generally derived from rice field conversion. In 2014, landuse change of Subak in North Kuta reached 123 ha [3]. The impact from Subak landuse change causing declining in rice productions and urban green space. Conversion of the landuse also caused by several factors including the regulation of the Regional Spatial Plan which sets the paddy fields is not entirely located on landfarm area [5].

This research aims to: (1) find out the landuse change subak in North Kuta and number of tourist accommodations using the ricefields over the last five years, (2) knowing Subak area which located inside and outside of landfarm area based on Regional Spatial Plan of Badung Regency.

2. Literature Review

Subak is the Organization of farmers who carry out irrigation areas, which each of its members has a certain area of rice fields, water springs, have autonomous and Subak Temple. Members of the subak irrigation water management is always based on the philosophical concept of Tri Hita Karana (THK). THK is one of life's philosophy that stems from the Hindu religion. Literally, the philosophy of Tri means three, Hita means happiness and Karana means cause. THK means three paths to happiness of life. THK philosophy consists of *Parhyangan* (the harmonious relationship between man and God), *Palemahan* (the harmonious relationship between man and the surrounding environment) and *Pawongan* (the harmonious relationship between man and other human beings). The implementation Subak in the form of the concept of *Parhyangan* can be seen by the existence of Pura Subak which is used by members of the Subak to perform worship to establish harmonious relationships with God Almighty. The concept of *Palemahan* can be seen by the existence of irrigation water management in the area of the rice field and the existence of elements of the rice fields. The concept of *Pawongan* can be seen from the organization of the autonomous nature of the Subak and the presence of Krama Subak (Subak member) [9].

Subak is one of the world's cultural heritage has been approved by UNESCO in June 2012. Subak has its own uniqueness that contrasts with other world cultural heritage. The uniqueness is meant that Subak as an organization of irrigation system management is a socio-cultural community, which in the Subak members achieved its goal has always been based on the concept of harmony and togetherness in accordance with the philosophy of THK as well as maintaining the balance of the environment [11]. Subak organisations based on socio-cultural community capable of providing the power of sustainability, because it was able to absorb the technologies that are being developed, able to adapt to the development of culture, simplicity the structure of the Organization and work system cooperative. Subak organisations also have the weakness that is not able to withstand the intervention of outside parties like the foreign investors which led to occur over the function of the land from the agricultural land into non-farming. The ability of human resources limited is one of the weaknesses in this water organizations. This condition is caused due to the agricultural sector is one of the jobs that are less sought after by the public especially the young generation today. In General farmers still till it was over 50 years old. The low interest in the community in the field of work to cultivate the farms because it has a high risk of loss. Another disadvantage on water level limited land ownership.

Each year the land area of the water always decline. This is because landuse change is high especially in areas close to urban and tourist areas. According to data of the Central Bureau of Statistics, the Subak in district of North Kuta has changed into non farming as much as 123 ha in the year 2014. the conflict between agriculture and tourism continues, resulting in wetlands being constantly pressured by the interests of non-agricultural development, both for housing and for the

infrastructure of objects and tourist destinations. Conversion of agricultural land has occurred due to the supply of land in Bali [6].

Some of the factors that cause a decrease in Water sustainability, such as the lack of interest the younger generation to work in the agricultural sector, a decline in the quantity and quality of irrigation water, wetland constriction due to land conversion to other uses outside of agriculture. The competition is the utilization of agricultural land or water resources between agriculture and tourism. In the competition always surrendered agricultural sector under the pretext of defeating the more promising generate foreign exchange to finance the construction of Bali and Indonesia in General. Proven reduction of farmland and converted to non-agricultural very significant [12].

As for the effort that can be done to conserve water is to maintain the sustainability of the paddy fields in Bali, maintaining sustainability of the resource water for irrigation, maintaining the boundaries between the clear water, maintain subak organization system that is flexible, strengthen institutional subak as well as maintaining the concept of harmony in the togetherness and the mindset of farmers in managing irrigation systems in accordance with the philosophical concept of THK [11]. In addition, there needs to be support from the government in protecting the priority of food land to meet food security and food self-sufficiency [8].

3. Methodology

3.1. Area of Study

Area of study is located in North Kuta Sub-district, Badung Regency, Bali Province, Indonesia. Geographically, North Kuta Sub-district located in 08°38'44,2"-08°43'32,6" South Latitude and 115°10'39,2"-115°38'42,3" East Longitude. North Kuta Sub-district bordering with Mengwi Sub-district in the north, Denpasar City in the east, Kuta Sub-District in the south and The Indonesian Ocean in the west.

3.2. Tools and Material

The material used in this research are spatial data as follows:

- Quickbird Satellite Image of Badung Regency in 2012 [5]
- Google Satellite Image year 2017 from obtained from Openlayers Plugin in QGIS
- Map of Regional Spatial Plan of Badung Regency in 2013-2033 with scale 1 : 50.000 [2]

While the tool used are:

- Computer to process the spatial data
- *QGIS* Software to perform geoprocessing analysis
- GPS (Global Positioning System) to determine the coordinate point of observation.
- Camera
- Stationary

3.3. Data collection

Data collection method used in this research is primary data and secondary data method.

- Secondary data consists of Quickbird Satellite Imagery data of 2012 and Badung Regency Regional Spatial Plan Area Map Year 2013-2033.
- Primary data (direct data source in the field) obtained from observing and recording the point of tourism accommodation in North Kuta Subdistrict using GPS. Coordinate point data is then incorporated into QGIS Software. The process resulted in a tourism accommodation map in North Kuta Sub-district.

3.4. Data Analysis

Data analysis in this research consist of two phase, which are

- Tourism accommodation analysis which come from Subak area during last five years and

- analysis of Subak land inside and outside of landfarm area based on Badung Regional Spatial Plan Map Year 2013-2033.

A. Analysis of Tourism Accommodation Derived from Subak Land in the Past Five Years

This analysis is augmented by inputting the Quickbird Satellite imagery of 2012 into QGIS software. The next step is to delineate the rice field located in North Kuta Subdistrict. The process resulted in subak land in North Kuta Subdistrict 2012. The 2012 Subak field is then intersected with Subak data of 2017 [10]. The result of overlapping resulted in changes of subak use of rice fields into non-rice field I for the last five years. The land use change data is then integrated with tourism accommodation data in the North Kuta Subdistrict that has been obtained during the field survey. The process aims to obtain a percentage of tourism accommodation data derived from paddy fields from 2012 to 2017.

B. Subak land analysis located inside and outside the Crop Farming Area

Based on the Regional Spatial Plan Area of Badung Regency Year 2013-2033 in North Kuta Subdistrict is not found Green Open Space there is only landfarm area. The first step is to input the map of landfarm area of Badung Regency on the Regional Spatial Plan Area of Badung Regency in 2013-2033. Registration map of landfarm area to equalize with Subak Map of North Kuta Subdistrict 2017 [10]. Subak map is then arranged with map of landfarm area, analysis of spatial data matching result of digitized subak with digitized landfarm area result, so it can be determined the width of subak paddy field which is likely to be converted in North Kuta Subdistrict based on subak rice field area outside landfarm area and subak which is located inside the landfarm area.

4. Result and Discussion

4.1. Analysis of Tourism Accommodation Derived from Subak Land in the Past Five Years

The intersect result result of Subak in 2012 with subak in 2017 resulting the Subak land use change in North Kuta Subdistrict. For the last five years Subak in North Kuta Sub-district experienced land conversion of 538.88 ha (35%). Subak land experienced the largest land conversion in each respective villages of Tibubeneng, Canggu, Kerobokan Kelod, Dalung, Kerobokan Kaja and Kerobokan. The use of Subak in North Kuta Subdistrict is transformed into gardens, vacant land, buildings and tourism accommodation. The increasing number of tourists North Kuta Subdistrict caused the rapid development of the villages so the agricultural land is decreasing. The rapid development of tourism poses a serious threat to Subak sustainability in Bali, especially in Subak at the tourism area with heterogeneous populations and many social economic facilities [1]. The tourism accommodation in North Kuta Subdistrict is presented in Figure 1.

Tourism Accommodation in North Kuta Subdistrict consists of three types i.e lodging, restaurant, and supporting facilities. Based on Figure 1, it can be seen that the pattern of wet land conversion to tourism accommodation in North Kuta Subdistrict is increasingly decreasing to the north. Kerobokan Kelod Village has the most tourism accommodation among other villages. The development of tourism accommodation in Kerobokan Kelod Village was earlier compared to other villages in Kuta Utara Sub-district. This is because Kerobokan Kelod Village adjacent to Legian and Seminyak whose tourism are well known.

Based on the results of the analysis of changes in Subak land use over the past five years, some of the development of tourism accommodation in North Kuta take advantage of Subak land. The number of tourism accommodation using Subak rice field is presented in Table 1.

Tourism accommodation using the most subak rice field is in Kerobokan Kelod Village. The number of tourism accommodation in Kerobokan Kelod using rice fields for the last five years is 33 inns and 19 restaurants. Figure 2 shows one of the tourism accommodation in Kerobokan Kelod Village which takes up rice fields. The development of tourism accommodation encourages non-agricultural development, either in the form of new tourism accommodation or other supporting

facilities such as settlement. The number of supporting facilities in North Kuta Subdistrict that utilize Subak land as much as 15%. While the number of inns and food stalls or restaurants that use Subak rice fields as much as 32%. Development that uses Subak land causes irrigation channels to be cut off. Irrigation systems in the disrupted Subak cause the cultivation process is also hampered [12]. Conversion of land area of Subak becomes bigger due to disrupted of farming cultivation. Land conversion creates some impacts, not only the direct impact on agricultural production and other related variables but also on environmental aspect [4].

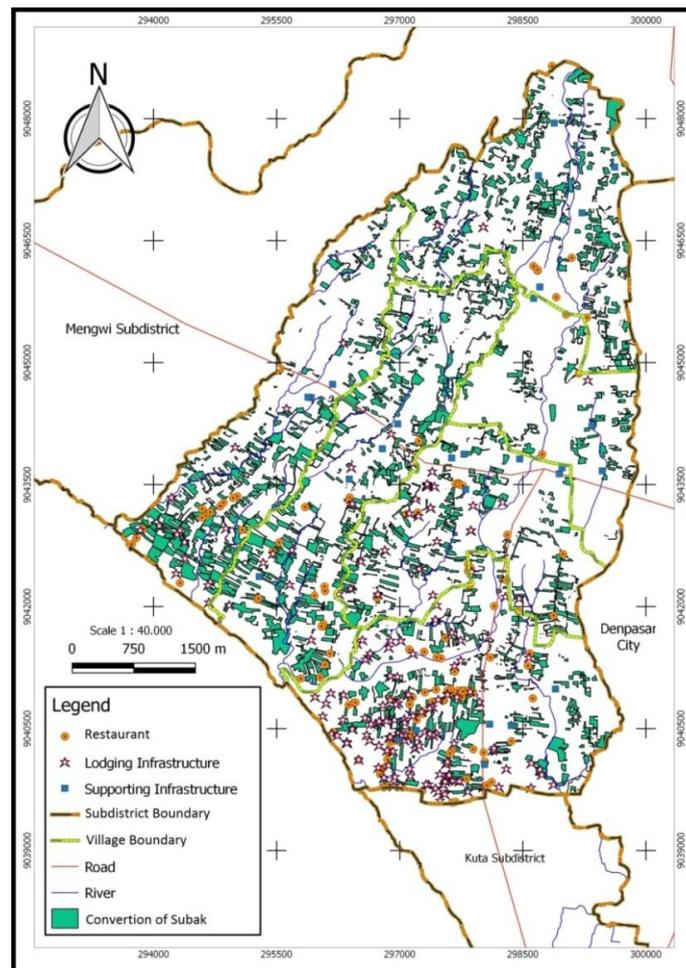


Figure 1. Changes in the Use of Subak into Tourism Accommodation

Table 1. Tourism Accommodation in North Kuta Subdistrict

| No | Name of Village | Supporting Infrastructure | | Lodging Infrastructure | | Restaurant | |
|----|-----------------|---------------------------|--------------------|------------------------|--------------------|------------|--------------------|
| | | Total | Using Paddy Fields | Total | Using Paddy Fields | Total | Using Paddy Fields |
| 1 | Dalung | 5 | 1 | 2 | 1 | 6 | 0 |
| 2 | Canggu | 3 | 0 | 16 | 11 | 13 | 4 |
| 3 | Tibubeneng | 4 | 1 | 10 | 2 | 17 | 9 |
| 4 | Kerobokan Kaja | 3 | 1 | 1 | 0 | 3 | 1 |
| 5 | Kerobokan | 6 | 1 | 22 | 6 | 14 | 2 |
| 6 | Kerobokan Kelod | 6 | 0 | 113 | 33 | 58 | 19 |



Figure 2. Tourism Accommodation Using Subak in Kerobokan Kelod

4.2 Analysis of Subak Located Inside and Outside the Landfarm Area

Subak spatial data in North Kuta Subdistrict intersected with landfarm area plan in Regional Spatial Plan Badung Regency Years 2013-2033 produces a stretch of Subak area inside and outside of landfarm area plan of Regional Spatial Plan of Badung Regency. The result is the area of Subak rice field located inside the landfarm area plan and outside the landfarm area plan. Table 2 shows the Subak area inside and outside of landfarm area in the Regional Spatial Plan Badung Regency. Subak which located in the landfarm area plan is a Subak rice field that can not be converted and planned as sustainable rice fields. Subak land area that is not in the landfarm area is Subak which most likely to be converted to be non rice field, so the possibility of landuse change is very big. Subak maps located inside and outside the landfarm area are presented in Figure 3.

Table 2. Subak Area Within and Outside The Lanfarm Area

| No | Name of Subak | Total Subak Area (ha) | Area of Subak (ha) | |
|----|------------------|-----------------------|-------------------------|--------------------------|
| | | | Inside of Landfarm Area | Outside of Landfarm Area |
| 1 | Subak Sebuah | 98,31 | 40,72 | 57,59 |
| 2 | Subak Tegal | 66,57 | 57,97 | 8,6 |
| 3 | Subak Muding | 38,52 | 8,14 | 30,38 |
| 4 | Subak Petitenget | 38,71 | 2 | 36,71 |
| 5 | Subak Kedampang | 76,47 | 52,02 | 24,45 |
| 6 | Subak Basangkasa | 72,63 | 42,76 | 29,87 |
| 7 | Subak Banjarsari | 31,42 | 2,45 | 28,97 |
| 8 | Subak Perancak | 35,38 | 4,88 | 30,5 |
| 9 | Subak Semat | 43,8 | 19,97 | 23,83 |
| 10 | Subak Bantan | 47,61 | 40,44 | 7,17 |
| 11 | Subak Daksina | 45,85 | 34,28 | 11,57 |
| 12 | Subak Dawas | 22,13 | 19,56 | 2,57 |

| | | | | |
|--------------|---------------|----------------|---------------|---------------|
| 13 | Subak Liplip | 25,57 | 19,62 | 5,95 |
| 14 | Subak Cunggu | 74,64 | 34,54 | 40,1 |
| 15 | Subak Umaalas | 13,34 | 10,51 | 2,83 |
| 16 | Subak Umadesa | 77,49 | 62,22 | 15,27 |
| 17 | Subak Bernasi | 71,73 | 59,27 | 12,46 |
| 18 | Subak Saih | 82,96 | 19,49 | 63,47 |
| 19 | Subak Gaji | 28,27 | 17,5 | 10,77 |
| Total | | 1007,39 | 548,35 | 459,04 |

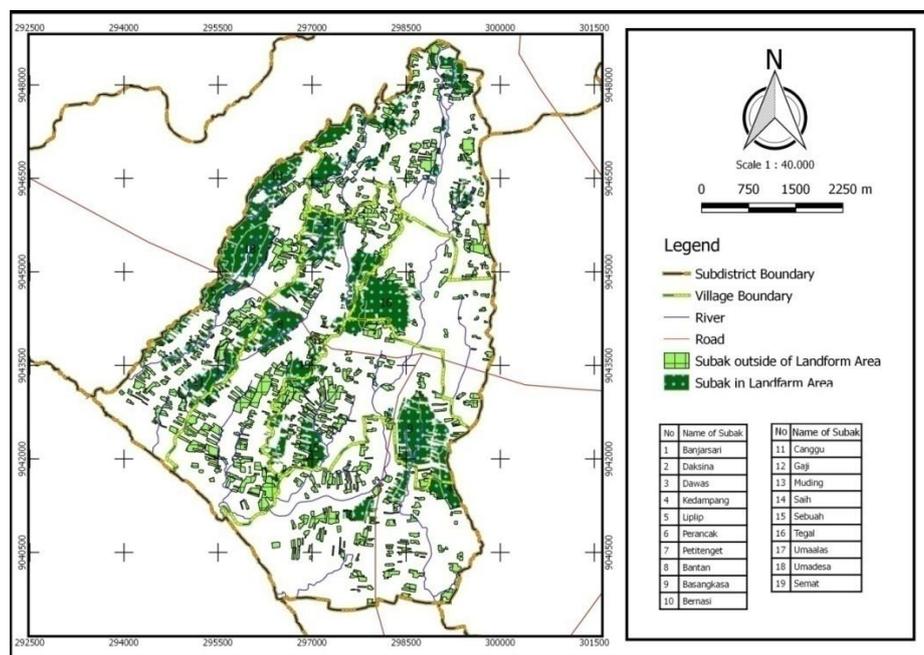


Figure 3. Map of Subak Which is Inside and Outside of Landfarm Area

Based on Figure 3 it can be seen that almost 50% of Subak area in Kecamatan Kuta Utara is located outside of landfarm area plan of Regional Spatial Plan Badung Regency. The subak area in North Kuta Subdistrict within landfarm area plan is 548.35 ha and the area of subak rice field outside ofland farm area plan is 459,04 ha. Highest Subak area which located inside the landfarm area plan is Subak Umadesa (62.22 ha) located in Cunggu Village, North Kuta Subdistrict mean while highest Subak area located outside land farm area plan is Subak Saih (63.47 ha) located in Dalung Village, North Kuta District.

Subak area of more than 50% in the landfarm area plan are Subak Dawas (88%), Subak Tegal (87%), Subak Bantan (85%), Subak Bernasi (83%), Subak Umadesa (80%), Subak Umaalas (75%), Subak Kedampang (68%), Subak Gaji (62%) and Subak Basangkasa (59%). While subak more than 50% of land outside of the landfarm area plan are Subak Petitengget (95%), Subak Banjarsari (92%), Subak Perancak (86%), Subak Muding (79%), Subak Saih (77%), Subak Sebuah (59%), Subak Cunggu (54%), Subak Semat (54%). Subak which is more than 50% of its land outside of the landfarm area is rice field located in the area close to Batu Belig Beach to Batu Mejan Beach (Echo Beach) and Dalung Permai Housing.

Land outside the landfarm area legally are possible to be converted to non-agricultural (settlements, roads, trade, services and tourism)according to its designation on he Regional Spatial Plan of Badung Regency. In contrast, the ricefields inside the landfarm area are not used for conversion. The area of

non-rice field in landfarm area plan in North Kuta Subdistrict is 273,18 ha (33%) in total. Its means that maximum of 33% of existing rice fields are able to be converted into non-rice fields.

5. Conclusions

North Kuta Subdistrict is an area of development of tourism in Badung regency. North Kuta Subdistrict experienced landuse change of 538.88 hectares over a period of 5 years from 2012 until 2017. Subak who experience land conversion to the use of tourism in general is on the tourist route Kuta - Tanah Lot. Tourism accomodation in North Kuta Sub-district that convert the Subak land for the last five years are as much as 92 accomodation (30.5%). Number of tourism accomodation in North Kuta Subdistrict which takes the most Subak land is in Kerobokan Kelod Village. The closer to the Kuta tourism center, the more rice fields that experience land conversion.

Subak rice field located inside landfarm area in North Kuta Subdistrict is 548.35 ha (54%) and outside of the landfarm area of 459.04 ha (46%). Land outside the landfarm area legally are able to converted into non-agricultural (settlements, roads, trade, services and tourism). In contrast, the paddy fields within landfarm area are sustainable rice fields that cannot be converted.

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