

**Tourism Development Impacts on Water Resources
in Northern Kuta District of Badung Bali**

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ARTICLE INFO

Received
27 February 2014
Accepted
10 August 2014
Available online
10 September 2014

ABSTRACT

One of the problem in the development of Bali tourism is declining carrying capacity supporting tourism resources, especially water. In the past, rural areas have never experienced a lack of water, by which presently facing a water crisis. This condition corresponds to the higher intensity of exploitation of water resources as a result of tourism development. The rapid development of business on accommodation facilities in North Kuta District is potential to accupy rice paddy and water resources. If this development is not properly controlled can cause negative impacts not only on the existence of the fields, but also for the potential of water resources. Tourism is significantly depend on adequacy of water resources to be able to function properly, thus in case of a water crisis in the tourist areas of Bali in particular, then sooner or later will create the economic crisis and the crisis of tourism. The research was located in North Kuta District aimed to know the impacts of the development of the tourism on water resources potential. In order to understand the impact on water resources used geography disciplines approach, and applying survey research methods. Tourism development is determined by the interpretation of Quickbird imagery in a different location. Carrying capacity of water resources is determined by using the guidelines of Per Men LH. No. 17 year 2009. Impact of tourism development on water resources was determined using comparative analysis of surface water and groundwater, both an quantity and quality. There were two patterns of land use change in North Kuta District, namely from the rice fields to tourist accommodation and from the dryland/orchard land, to tourist accommodation. Changes from rice field for about 16 years (1992-2008) in North Kuta District was 1,218.44 Ha. Carrying capacity of water resources was considered deficit at all village in North Kuta District. Development of tourism, especially tourism accommodation has changed land cover in an resulting increase in coefficient of flow, so that more rain water flowing on the surface than into the ground water as a reserve. Development of tourism in the Northern District of Kuta had a negative impact on potential water resources both quantity and quality. On quantity aspect, an increase in runoff discharge 3,255 lt/sec/year and declined of the water table resulting in resources from shallow groundwater to deep groundwater in. On quality, water resources have indication of pollution and salinity content in groundwater has reached at a distance of about 3 km from the beach, as an indication of the occurrence of seawater intrusion.

Keywords: tourism development, water resources, carrying capacity,
Northen Kuta.

Introduction

Background

Tourism is an industry whose operation requires resources and generates wastes. However, in need of resources, tourism tends to compete for scarce resources and often becomes the winner (Wall and Mathieson, 2006). This often results in an imbalance in resource utilization between the needs of tourism and those of other sectors. In the end the quality of the resources will be damaged and the environment in general has its reduced quality.

The development of tourism that can have an impact on the environment, including the impact of the construction of tourism facilities, the impact of the use of means of transportation, and the impact of the operation of the tourism industry (Richardson and Fluker, 2004). The development expansion of tourism infrastructure (hotels, villas, bungalows, restaurants, shops, golf courses, etc.) so quickly leads to dwindling agricultural land areas drastically. JICA study estimates that during the period of 6 years (1997-2003) rice field areas in Bali were reduced from 87,850 hectares to 82,644 hectares. That is, the rate of conversion of paddy fields reaches 870 hectares (1.0%) per year. These data give a sense of endangerment of the sustainability of Subak, a traditional Balinese farmer organizations that have been well-known throughout the world.

Changes in land use may affect the size of the water that seeps into the ground and flowing on the surface, thereby determining the availability of water in an area. One of the crucial issues in the development of tourism in Bali is a change in the carrying capacity of the environment, particularly in the provision of clean water. Rural areas that once almost never experienced a drought of water resources recently has had to face a crisis that is not classified as mild. It is associated with higher intensity of exploitation of water resources due to the development of infrastructure and tourism facilities. The volume of water consumed by the tourism accommodation in Badung, which is 1,500 liters per room per day, far greater than the need for clean water which is only 120 liters

per capita. Even hotels in the tourist area of Ubud, in particular in the village of Kadewatan require 2,500 liters of water per room per day (Sunarta, 1994). This shows that, the water needs for tourism varies greatly depending on the type of accommodation. Hotels, villas, homestays, or cottage will require different water in the operation.

Development of villas as a means of tourism accommodation in Bali seems to be used as one example of the development of tourism industry that is not planned in advance. It can be seen from its fast development like without control. The existence of villas having several potentials receive considerable attention from many parties, either positive or negative potential, such as physical growth, designation, licensing violation, seizure and exploitation of resources, pollution and so forth. Accommodation business developments such as villa were growing rapidly, especially in the district of Kuta, and even more in the district of North Kuta. The development of this business property will certainly utilize rice fields and requires not little water resources. Studies on the development of rice fields in Bali show that from 1990 to 2020 the number of rice fields has decreased drastically. By using a high-growth strategy (strategy 5) rice fields in Badung/Denpasar are assumed to be finished in 2020 (Wiranatha, 2003). It is also noted that, the comparison between the potential availability of clean water and total fresh water needs in Badung/Denpasar will be minus / deficit in 2020. The most interesting thing in the study is for all the strategies, starting from the basic strategy to the water balance high growth strategy in Badung Regency/Denpasar will be minus/deficit. This condition will of course greatly affect the water system and irrigation in Badung Regency.

Tourism development and infrastructure could lead to a significant change on natural resources. This problem is often compounded by the fact that tourism often occurs in areas that have high biodiversity, thus becoming one of the major driving forces behind the destruction of resources in the region (UNEP, 2003). Given the growing number of villas in Badung Regency of especially in North Kuta District of North, it will certainly have an

impact on the socio-economic life of the community but also on natural resources, especially land and water, both in quantity and quality.

This phenomenon is interesting to study, to reveal more about the impact of accommodation business development on water resources in North Kuta District as the region with the most rapid development of tourism in comparison with four other districts in Badung Regency. Components of water resources will be affected by tourism development such as groundwater and surface water, both in quantity and quality. A component of water resources which is of no less importance is the runoff that could potentially lead to flooding. In addition, the research further intends to identify negative impacts that arise as early as possible so that it can be known by all tourism stakeholders. The results of this study can also be used as a material consideration in planning the development of tourism in Badung Regency.

Research Objectives

In general, this study aims to assess the development of accommodation businesses and analyze the impact on water resources in the district of North Kuta. In particular, this study aims to assess and analyze:

- 1) The development of business accommodation that occurred in the district of North Kuta, especially hotels, villas, lodging, restaurants, and residential areas which could potentially cause impacts on water resources.
- 2) The amount of the carrying capacity of water resources in meeting the needs of residents and tourists in the District of North Kuta.
- 3) The impact of the development of business accommodation on the component of surface runoff, potentially leading to flooding.
- 4) The impact of the development of business accommodation on potential ground water both in quantity and quality.

Literature Review

Previous Research Studies

Several studies on the impact of tourism developments that have been undertaken and are considered relevant to this research, among others; development of tourism related to the existence and the essence of the development of villas; the impact of planning policies of tourism accommodation facilities of the development of villas; the impact of tourism on the development of the socio-cultural environment, the physical and economic environments; the impact of hotel and restaurant developments on groundwater quality. In addition, several literatures and some research findings that have been done by foreign researchers either conducted in Bali or outside Bali.

Wiranatha (2003) in his dissertation entitled "A System Model for Regional Planning towards Sustainable Development in Bali Indonesia" much discussed the modeling related to sustainable development in Bali. In chapter 6 on "Modeling of Natural Resources and Pollution" discussed a lot about land resources system and water resources system. By using five strategies starting from basic growth strategy (strategy 1) to the high-growth strategy (strategy 5) can estimate the development of rice fields area and fresh water balance in the area of research. The development of rice fields in Bali using the strategy 5 decreased from 105 705 ha in 1990 became 69 965 ha in 2020. Using the same strategy, the estimated rice fields in Badung/Denpasar which will finish in 2020 for all levels of water balance strategy in Badung Regency/Denpasar will undergo a deficit/minus in 2020.

Negara (2010), entitled "Impact of Tourism Accommodation Facility Planning Policy Implementation on the Development of Villas in Badung Regency. It was found that the level of awareness of accommodation businessmen was very low in terms of licensing. There were only 19.29% of legal villas, licensing violations reached 80.71%. Villa development conditions before the policy tend to cause problems, such as violations of Spatial Planning, environmental pollution and sacred areas. Cullen, 2003, entitled "Tourism,

Water and Waste in Westland: Implications of Increasing Demand on Infrastructure." This study presents several findings that the tourism development in tourism areas will require the supply of plenty of water and produce wastes that can damage the potential of groundwater and surface water. The cause is not only by tourist behaviors but also inadequate facilities and infrastructures.

Rathore (2012), on the impact of tourism development in rural India, opportunities and challenges. This study further strengthens the belief that the development of tourism in addition having its positive impacts it also results in a negative impact. The negative impact is due to the fact that the development of tourism will always require infrastructure which in its development tends to exploit local resources so as to decrease the quality of the resource. What is interesting in this study is that the development of tourism in rural areas should not be made en masse. This shows that developing a product must really determine the specific and unique potentials owned by the village, without having to follow the willingness of most tourists. This strategy is part of the concept of sustainable and environmentally-based tourism developments.

Tapper *et al.* (2011) in their study in 17 tourism destination countries suggested that tourism development has a negative impact on water resources. Water demand which exceeds the available supply in many popular tourist destinations has caused water shortages. It has serious effects on the surrounding community, natural habitats, and the tourism sector itself, as well as undermining the goal of sustainable development. All the tourism destination countries included in the study their water resources are under very serious pressure, the cause is a combination of interrelated factors, among others: Physical Scarcity, the causes include running out of supplies (Malta, Spain, Greece), drought (the Caribbean Morocco), pollution (including tourism), and salt water intrusion caused by over-exploitation; Economic scarcity, including a lack of infrastructure, poor water management and lack of demand management (e.g. Kenya, Egypt, the Caribbean); Rapid urbanization and unregulated tourism development, increased utilization of the scarce water resources and causing contamination of the supply of water

resources by unmanaged waste (Tunisia, Egypt, Yucatan); Population growth and tourist fluctuation: including seasonal effects during the tourism season (Caribbean).

Associated with the use of water in tourism particularly by tourists, a study suggests that a tourist in Grenada, Spain generally use 7 times more water than local people and this difference is usually the case in many developing tourist areas. In tropical regions such as the Mediterranean, the problem of water scarcity is of particular concern, because of the hot climate and tourists' tendency to consume more water when on holiday than they do at home. The amount used by tourists can reach 440 liters a day, it is nearly twice the average usage of Spanish townspeople.

UN Secretary General, Ban Ki-Moon in his speech delivered in commemoration of "World Tourism Day" 27 Sept 2013 on the topic "Tourism and Water, Protecting Our Common Future" saying that: climate change and the unsustainable consumption threatens global water resources, and the responsibilities of the tourism industry to maintain and manage water properly. Ban Ki-Moon encouraged tourism companies to reduce consumption and improve waste management and asked to play their part by making environmentally conscious choices when they travel. By doing water saving as a priority, then we can all help to build the future we want.

Theoretical Basic

In general, this dissertation raised the topic: The impact of Tourism Development on Water Resources in North Kuta. In general, some of the theoretical foundations are concerned with the life cycle of tourism, planning and development of tourism, the impact of tourism development, and the cycle of water resources.

Tourism Destinations Life Cycle (Life Cycle Tourism)

As social and economic activities, tourism certainly has a life cycle. Butler (2006) conceptualizes the life cycle tourism as a cycle that resembles the letter S, which consists of stages like the exploration stage,

involvement stage, development stage, consolidation stage, until finally entered the stagnation stage and then between rejuvenation (rejuvenation stage) and attenuation (decline stage). The theory offered by Butler about the life cycle of tourism is still too common and difficult to be operationalized. It is quite difficult to determine at which stage a tourism condition is. But at least Butler's theory can provide directions that tourism needs to be managed well, so it does not stagnate, but continues to experience rejuvenation.

Planning and Development of Tourism

Planning is a major step that starts a whole series of activities of a work organization which has the function of placing the starting point of the organization's activities further, as well as directing all the resources, facilities, processes and programs based on the specified policy to achieve the objectives of an organization. Planning is the whole process of thinking and careful determination of the things that will be done in the future in order to achieve predetermined objectives. Some important things to consider in planning, namely: a) Planning is an activity that is comprehensive of a work organization, not just a part of the action; b) that planning is a process with several ongoing and continuous activities; c) Planning is a result of thinking and determination that can be said to be a policy decision; d) that planning is something that is done in the future, but it can be determined at this time that is an act through high intellectual hunch; e) that planning is a means for the achievement of a goal, arguing that the purpose should be determined first, new planning can be made; f) that planning is a standard that provides a description of the objectives to be achieved.

Other experts say that planning is organizing the future to achieve a definite goal. Related to tourism planning, Gunn and Var (2002) suggests that; if the objectives of the development of tourism is to obtain a better economic impact, then tourism should be well planned so that tourists feel comfortable, people are made involved and the important thing is to protect the resources so as not to degrade.

Tourism areas will always experience growth. Miossec analyzed the development of tourism with the use of four key characteristics, namely the resort, transportation, tourist behavior, and attitudes of decision making and residents in the destination area, which became known as the Miossec model of tourist Development. The model as a whole provides a perspective on the development and is shown by the development graphically in an interrelated way from a tourism stage to a very advanced stage in the fifth phase. In the early stages (0 and 1) the areas are still isolated, there is little progress, and tourists still have a vague idea of the destination area, while local residents tend to have polarized views on whether tourism can bring them to a better direction? The success of the pioneer areas leads to further development (stage 2). As tourism is growing, hierarchical systems are thus increasingly complex, resort and transportation networks develop.

The development of tourism is a series of efforts to achieve coherence in the use of various tourism resources integrating all forms of outside tourism aspects relating directly or indirectly to the continuity of tourism development (Swarbrooke, 1999). In tourism development some aspects are required to support the development, namely: 1). Physical aspects, such as; geography, topography, geology, climatology, hydrology and vegetation; 2). Aspects of tourism attraction, among other things, the appeal of nature (natural attraction) such as climate, landscape, flora and fauna; 3). Accessibility aspects both physical and non-physical. 4) Aspects of Activities and facilities, such as accommodation, restaurants, art shop; 5) socio-economic and cultural aspects.

Impact of Tourism Development

The development of tourism can cause negative impacts on the environment, especially when carried out without management standards designed to protect the environment (UNEP, 2003). The negative impact is mainly caused by activities such as infrastructure development, and use of resources. Excessive resource use and waste generated resulting in damage to the quality of the resources, such as land and water.

Tourism development usually requires some form of infrastructure, which may result in significant changes of natural resources. This condition is compounded by the fact that tourism often occurs in areas of high biodiversity, such as coastal areas, mountains and protected areas. Tourism development can be concentrated using local resources in rural areas and undermine local resource management systems (UNEP, 2003). Development of new infrastructure often increases pollution caused by waste water. This can have a negative impact on coastal biodiversity, particularly in areas that have the coral reef potential. Tourism produces 35 million tons of solid waste per year, roughly equivalent to the French state (UNEP, 2003).

Sonak, (2004) describes the general impact of tourism activities, especially in coastal areas. Tourism activities will require water that is typically derived from groundwater, causing groundwater levels to decline. The decrease in groundwater levels indicates that groundwater discharge to undergo a decrease, so that sea water will get into the ground water which is called intrusion. This shows that the tourism activity has an impact on the aquifer of ground water. Tourism activities would also require land for the construction of hotels and the like, as well as other infrastructure, resulting in a change of use and land cover. If the change of land use from rice fields/ other plants into a physical building, then it is almost certain to result in run off that is likely to cause flood. Tourism activities will need food, energy and transportation. This will affect the ecosystem in the surrounding area, and can damage the resource in the area.

Impact on Water Resources

Water Resources is the gift of God Almighty providing benefits for the welfare of the whole people of Indonesia in all fields. Article 33 Paragraph 3 of the Constitution of the Republic of Indonesia in 1945 states that water resources are controlled by the State and used for the welfare of the people fairly. This means that the state guarantees the right of every person to get water for the fulfillment of the basic daily needs and make arrangement for the rights of water. State control over water resources is organized by the government

while recognizing and respecting the units of customary law communities along with their traditional rights, such as the customary rights of local communities and other similar rights.

This shows that the traditional rules that exist in an area has accommodated role in legislation, particularly the Law of Water Resources. In line with the increasing development, human need for water is increasing as well. It encourages the increasing economic value of water in comparison with the value and its social function. The condition has the potential to create conflicts of interest between sectors, between regions and the various parties related to water resources. On the other hand, the management of water resources which relies more on the economic value will tend to favor the owners of capital and can ignore the social function of water resources. Based on these considerations, it has also been stated in the Law of Water Resources, about the management of water resources which are more concerned with weak economic groups by applying the principle of water resources management which are able to align social, environmental and economic functions.

Cycle of Water Resources/Hydrology

Water as the source of people's lives naturally its presence is dynamic flowing to a lower place regardless of administrative area boundaries. The presence of water follows the hydrological cycle that is closely related to weather conditions in an area, causing uneven water availability in every time and every region. Population growth and increasing community activity result in the changes of environmental functions impacting negatively on the preservation of water resources. It requires good management of water resources from upstream to downstream with the river basin basis in the pattern of water resource management without being affected by the boundaries of the administrative areas in its path.

Hydrology is the science which is a branch of physical geography related to water on earth, the occurrence, circulation and distribution, chemical properties, physical and relationship with its environment, including its relationship with hydrology as its basic

science (Kodoatie and Sjarief, 2010). The water in the hydrological cycle may be water in the air in the form of vapor and rain; on the mainland in the form of snow, and water on the surface, in rivers, canals, reservoirs, lakes, marshes, and sea water; as well as groundwater. The sea water has different characteristics and requires the handling as well as a separate regulation. Utilization of sea water on land for the purposes of exploitation need to pay attention to the environmental function and must obtain government permission in accordance with their authority.

Framework of Thinking and Concepts

The development of tourism, which is indicated by the development of the accommodation business, will require land and water resources, and generate waste. In need of land resources, tourism development will lead to changes in land use, especially of paddy fields into a hotel building and other supporting facilities. This will lead to changes in runoff coefficient and the amount of runoff. The change of rice fields into tourism facilities will result in ground water recharge decreases so that runoff increases and potentially leads to flooding.

The development of tourism can cause a variety of negative impacts on natural resources, particularly when carried out without management standards designed to protect the environment (UNEP, 2003). The development effort will require accommodation of water large enough and can impact the carrying capacity of water is an important component in ensuring the sustainability of tourism. The development effort will require water accommodation which is generally taken from groundwater, causing groundwater levels to decline (Sonak, 2004). The decrease in groundwater levels indicates that groundwater discharge undergoesa decrease, and the potential availability of groundwater is reduced. The decrease in ground water level, besides being caused by excessive ground water drilling, is also caused by reduced rainfall catchment area because of being covered byaccommodationbuildings, roads and other physical buildings. In coastal areas, the decline in ground water level by excessive drillings, will lead to sea water intrusion into the

mainland. This situation occurs because the ground water pressure becomes smaller than the sea water pressure, so that over time the quality of the groundwater becomes polluted and unfit for consumption as drinking water. Water pollution essentially occurs due to waste water directly discharged into water bodies or into the soil without processing it first, or the processing performed is inadequate. Sources of water pollution can come from household waste, waste of accommodations /hotels, agricultural and industrial wastes. Water that is used in the operation of most of the accommodation will be disposed of in the form of wastes. Wastewater is generally discharged directly to surface water, such as irrigation channels, river basins, finally gets to the beach. Disposal of this waste water can contaminate ecosystems that it passes by, including irrigation water, rivers and beaches, as well as brings a negative image for tourists and tourism in general.

This dissertation research focuses on assessing the impact of business accommodation development in North Kuta District. This study covers three issues, namely the development of business accommodation, the carrying capacity of water resources and the potential impact on water resources. The research problems were addressed by applying some theories, such as tourism area life cycles, water cycle theory, the theory of carrying capacity and the impact theory. Results of the study were then interpreted and summarized and the suggestions were given for the preservation of water resources and the sustainability of tourism in Bali

Methodology

Business accommodation development referred to in this study is all physical developments related to tourism such as; hotels, villas, home stays and houses which are functioned as houses for rent or lease/boardings, and private homes, which support tourism. While the definition of water resources is a condition of surface water and groundwater, both in quantity and quality. Impact referred to in this study is the change in the potential of water caused by the development of tourism in the study area.

Business accommodation development seen in this study of the development of business accommodation, settlements, fields, fields, and roads which is a component of land use changes that occurred in the study area with the assumption that the land use changes that occur as a result of tourism development. The data needed is a map and imagery/aerial photography in a different year to determine changes in land use in the study area. By overlaying the two aerial photographs, changes in land use were obtained, which is an indication of the development of tourism in the study area. With changes in land use, coefficient runoff changes can also be identified (coefficient runoff will be explained further in the method of water carrying capacity). Coefficient runoff would then be used for determining the magnitude and changes in surface runoff that occurs in the area of research, so that the impact of tourism development on surface runoff can be known.

Method of calculating water carrying capacity considers the availability and the need of water resources for residents and tourists in the area of research. The calculation result will be able to know in general whether the water resources in the study area in a state of surplus or deficit. The surplus state indicates that the availability of water is adequate, while the deficit state shows the insufficiency of the need for water in the study areas.

The determination of the impact of the development of business accommodation on the potential of water resources will basically be seen from the quantity and quality potentials. Development of business accommodation will be seen from land use maps in different years (after 2006 and before 2009). Land use changes reflect changes in land utilization. Changes in land utilization especially in the field of tourism, such as accommodation, restaurants, art shops, mini markets, and roads including settlements result from tourism development that occurred in the study area. The development is then able to change the runoff coefficient. The big change in runoff coefficient is later called the impact of the development of business accommodation on the water surface.

The impacts on groundwater potential will be evaluated from the amount of water usage by the accommodations in the area of research. Utilization of ground water by the tourism activity can result in declines in soil water potential in the area of research, which can be seen from the drop in groundwater level in the wells of the local people, especially in the dry season while the impact of accommodation business development on water quality will be seen in terms of the quality of surface water/river and ground water caused by wastes generated and disposed of in the water bodies.

Results And Discussion

The results of this study can be expressed as follows. Based on data from the Badung regency it can be seen that the development of accommodation property in the district is very rapid. The growth of budget hotels within seven years (2006-2012) were at the average of 10.05%, i.e. from 347 hotels with the number of rooms was 8,618 in 2006, expanding rapidly into 667 pieces with the number of rooms was 22,684 in 2012. The growth of tourist lodge in the same period was at the average of 23.37%, i.e. 165 pieces with the number of rooms was 799 in 2006, developed into 688 pieces with the number of rooms was 3,013 in 2009. The property development would also take place in the district of North Kuta which had 204 pieces of accommodations / inns in 2010. The development of accommodation will utilize the land in its development, so that land use cannot be avoided. The district of North Kuta has the biggest land switch compared with other districts in Badung Regency. Paddy land conversion that occurred in the District of North Kuta has increased in the last three years. In 2010, 10 hectares of rice fields switched their functions, and increased to 29 hectares in 2012. The conversion of rice fields that occurred in the district of North Kuta approaches 10 hectares per year.

The change in land use in South Kerobokan from rice fields into non rice fields was 21.25 hectares and the shrinkage of vacant land was 12.66 hectares. So there has been a total of 33.91 hectares of land that undergo changes of function into built spaces in South Kerobokan for 3 years (average of 11.30 ha /

year). Similarly, the ratio of built spaces with green land area in South Kerobokan in 2009 shows an alarming rate, which reaches 68.9%, meaning that the area of built spaces has reached more than half of the available total green land areas/open areas.

The changing dynamics of land in Canggü is relatively slower. The rate of reduction of rice fields has been recorded only 0.94 ha, 0.09 ha farm lands, and 1.34 ha mixed farms. So totally there are about 2.37 hectares of rice fields, farm lands, and mixed farms that undergo a switch in function (an average of 0.79 ha/year). Similarly, the increase of land area that serves is relatively small, that is, 3.75 Ha. However, if this data were linked to real rural context what would be happening in Canggü already shows the development of a quite dynamic land use change.

Status of the water carrying capacity is derived from the ratio between the amount of water availability. In general, the status of water carrying capacity in North Kuta District is deficit with the status value of the water carrying capacity below 1 or 0.27. The amount of water deficit for the District of North Kuta was 79.55 million m³ / year (only considering the population) and 149.357 million m³ / year taking into account the water needs of residents and tourists. The status and the value are an accumulation of environmental factors that affect the amount of water availability and water level. The whole villages in the district of North Kuta have undergone water deficit. Looking at the value of the water carrying capacity, it is seen that the village having dense settlements and large population, the value of its water carrying capacity is very small. As shown by North Kerobokan Village with water carrying capacity value of 0.14, followed by the Dalung Village which is 0.19.

Based on the comparison between land use map produced from the image QuikBird in 2009 and the plan of land use in the South Kerobokan Village, it is clear that the development of tourism/accommodation planned was already not in accordance with the situation in 2009. The development of tourism/accommodation which was planned only along the beach turned out not to comply with the condition in 2009 in which the building development is almost evenly spread

in all places in the village. Something similar is found in the village of Canggü, albeit with a lower rate of growth than in South Kerobokan Village. New buildings developed in accordance with the pattern of the existing roads in the village, which extends from the north to the south in accordance with the shape of the village.

By referring to the overview of land use changes that occur in the two villages, there are three dominant land uses, namely buildings or properties, settlements, and rice fields. Although the use of land for a swimming pool almost exists in each building/accommodation, but because its area is relatively small, the changes are not visibly large or the changes are relatively small. Changes in runoff discharge in South Kerobokan Village in 2006 and 2009 were relatively small. The changes in the same period in the village of Canggü apparently showed a smaller number, even not visibly changed.

Village of South Kerobokan with its more rapid development of tourism poses a greater impact than the village of Canggü. The distribution of impact size per month is in accordance with the amount of precipitation that falls on that month. The months that have large amounts of rainfall (rainy season) have a greater impact than the months that have little rainfall (dry season). The average impact caused by the development of tourism on the surface of the stream in the village of South Kerobokan is 0.48 M³/sec or equal to 480 liters/sec. This shows that the result of the development of tourism in the village of South Kerobokan will cause an average increase in surface runoff of 480 liters/second.

Different conditions occur in the village of Canggü, where the impact of tourism on the development of surface runoff in the village is much smaller compared with what has happened in the village of South Kerobokan. The average impact occurs in the village of Canggü, 0.06 M³/sec or 60 liters/second. The increase in surface runoff of 60 liters/sec serves as the impact of tourism development that occurs in the village of Canggü.

The impact that occurs in two villages reflects the impact of tourism development that occurs in the District of North Kuta. By using the average impact that has occurred in the two villages, it can be argued that the impact of tourism on the development of surface runoff in the District of North Kuta is 270 liters/second. The impact of tourism development on the surface runoff in the district of North Kuta shows results that are not so great. This situation can be given reasons, among others; development of tourism in the District of North Kuta is not yet so great; the use of land in the district of North Kuta is still dominantly irrigated areas, so that the land is already relatively saturated with water; and changes that have occurred are more dominantly in the form of villas whose coefficient runoff is not much different from the previous land use.

Development of tourism, followed by accommodation and population growth will not require little water resources, which can damage water resources themselves. Based on field observations and interviews in South Kerobokan Village and the village of Canggu, it can be seen that the average water demand for accommodation/lodging in the District of North Kuta. The average water needs for accommodations / villas is 1,695 M³/day/room or 32.72 M³/month/villa. By using the data of accommodation/lodging amount of 204 pieces, the water demand for accommodations in North Kuta District in 2010 amounted to 6674.88 M³/month or a total of 2.58 liters/sec.

Based on the survey results, people who use shallow wells for water complained that the well water has decreased, especially in the dry season. Eventually the population shift to utilize groundwater (deep wells) with the range between 40-50 meters and/or utilize water from water taps. Likewise for accommodation/lodging, which generally prefers utilize ground water with relative grounds easier to get and the quality is better than the free ground water/shallow. Besides, the utilization of ground water free/shallow likely will be easier and faster known negative effects.

Development of accommodation and population is the dominant component in the

development of tourism in the District of North Kuta. In utilizing the water resources to meet their needs, these two components chosen to use permeableground water / at the amount of 123.71 liters/sec. 204 water needs accommodation/lodgings of 2.58 liter/sec and the needs of 61 926 inhabitants amounted to 121.13 liters/sec. By comparing the water needs of the residents of the property and the potential for ground water availability depressed by 8 million m³/year or 257.20 liters/sec, the water that is used by the provision of accommodation/lodging and the population is still below potential ground water availability in the area

Based on the comparison of the results of the analysis of the sea water quality standard for marine tourism (Bali PerGup No. 8 of 2007), there are three parameters that the levels are not in accordance with the quality standards established, namely PO₄ (phosphate), NO₃ (nitrites), CL (Chlorine) and salinity (salt content). The range of phosphate levels in all three beaches is between 0.011 and 0.018 Mg/l. Although relatively small, but the quality standards of coastal tourism does not allow the content of phosphate in sea water. Phosphate contained in seawater is generally derived from the decomposition of dead organisms. This level is increasing with the influx of domestic and industrial waste, especially waste containing detergents; agricultural waste (manure) contains phosphates very much. Increased phosphate pollution results from over fertilization in agriculture and the rise of businesses that use a lot of laundry detergents. Increased levels of phosphate in the sea would cause phytoplankton blasting and algae blasting on coral reefs.

Salinity levels based on the quality standards of coastal tourism in accordance with the recommended natural levels of seawater has a salinity level of 30-35 ‰. By looking at the results of the analysis, only the water in the Canggu Beach whose salinity level is 29.0 ‰, is below natural level of sea water. While the water in Berawa Beach and Petitenget Beach, its salinity levels remain slightly above the lower limit of the natural salinity levels, namely 30.7 ‰ and 30.1 ‰ respectively.

Limitations of Research

In this research, the development of businesses accommodation is known by using secondary data and the image of QuickBird in 2006 and 2009. This is believed that the development of accommodation after that will be more rapid so that the implications would result in a greater impact as well. In QuickBird image analysis, all kinds of changes in land use are used to determine the impact on surface water. The potential impact on groundwater is known from decreased water level obtained from the interviews with the community.

Research Implications

Theoretical Implications

Based on the analysis of the relationship between variables, the theoretical implications of the research results can be described as follows:

- 1) The development of tourism in the District of North Kuta indicated by the accommodation development has led to the deficit of rice fields and reduction in the carrying capacity of the water so that the water resources are becoming increasingly critical. These research results reinforce the research conducted by Wiranatha (2001) which says that the rice field in Badung/Denpasar will finish in 2020, and there has been an imbalance between water availability and the needs of water, even water resources will be a deficit also in 2020. Cullen *et al.* (2001), Cullen, Dakers and Meyer Hubbert (2004) and Wall and Mathieson (2006) claim that tourism development can reduce the potential of water resources in tourism areas. Cole (2011) points out that the uncontrolled development of tourism will lead to lead to water crisis in Bali. Angela, H. (2011) says that the use of water and land in the area of the development of quality tourism dominated by the villa is bigger than the area of the development of mass tourism, which is dominated by five-star hotels.
- 2) The development shown by the tourism accommodation businesses in the District of North Kuta has a negative impact on water resources. There has been a decrease

in ground water level and water pollution. Results of this study has reinforced UNEP (2003); Sonak (2004); Tapper *et al.* (2011) who maintain that the development of tourism has resulted in negative impacts on water resources. UNWWD (2003, 2006) states that tourism; especially hotels and tourists consume a large amount of water, producing about 7% of wastewater pollution and generating 180 liters of waste water per tourist per day. Development and infrastructure of accommodation in the tourist areas have resulted in pollution of ground water and surface water. Utami (2004) states that the quality of groundwater as a source of water used by the tourism industry in Bali Kuta has been contaminated.

Managerial Implications

- 1) The development of tourism in North Kuta District indicated by the accommodation developments has resulted in a reduction of rice field and the deficit of water carrying capacity. Governments can reinforce the implementation of the rules and tighten up building permits and permits for business accommodation and drilling of groundwater. The community can participate in monitoring and following up if found development and groundwater that violates the rules, and can damage the development of tourism in the region.
- 2) The development shown by the tourism accommodation businesses in the District of North Kuta has a negative impact on water resources. There has been a decrease in ground water level and water pollution. The government can make a rule requiring employers to make accommodations infiltration wells and sewage treatment systems. The community preserves the water resources in the region.

Conclusion and Recommendation

Conclusion

Development of tourism in the District of North Kuta indicated by the accommodation developments has resulted in a reduction of rice fields. In South Kerobokan Village rice fields reduced to an average of 7.08 ha/year, in

line with the increase in the amount of tourism accommodation building at an average of 6.90 ha/year, while the paddy fields in the village of Canggu just reduce to an average of 0.31 ha/year and an increase in the accommodation business buildings average only 1.25 ha/year.

Carrying capacity of water resources in the District of North Kuta has been categorized as deficit, although it only considers the population. Development of tourism which is followed by the increasing number of tourists, and other supporting facilities, has added pressure to water resources. Therefore, the status of water carrying capacity in the District of North Kuta which is already deficit will get its worse condition.

Accommodation business development in the District of North Kuta has a negative impact on the potential of water resources. Accommodation business development has changed land cover resulting in increased value of the coefficient runoff, so that the rain water flowing on the surface is more than it soaks into the ground as water reserves. The impact of accommodation business development on surface runoff in North Kuta District was 270 liters/second per month, or 3255 liters/sec per year. The decrease in ground water level has resulted in the tendency of people to deepen bucketwells, and divert its source into deep wells. The content of salinity in the water has exceeded the standard set. This situation indicates that the groundwater discharge has decreased due to the use of ground water that goes beyond its potential.

Recommendation

Badung Regency Government together with the community in the District of North Kuta, should make an evaluation of the development of tourism in the region, because it is not in accordance with the plan that has been made, and has resulted in a decrease in rice field areas, as well as it has a negative impact on water resources in the study area.

Preventive action needs to be done to tighten up building permits and permits for groundwater, as well as an integrated supervision. All stakeholders in tourism, spearheaded by the government should make

efforts that can reduce damage to water resources and the sustainability of tourism, such as re-arranging the utilization of water resources, efficient water use, making infiltration wells that are on target, and maintaining and preserving the catchment areas.

It is expected to have further research that can strengthen the results of this research, by digging more primary data derived from the tourism industry and the public. The impact of the development of business accommodation needs to be expanded to other components of the tourism and not only see the physical impact, such as water and land, but also the social, economic and cultural impact. In addition, this research is also expected to be done in other tourism development areas in Bali, so that the balance and continuity between the development of business accommodation and the potential of water resources on the island of Bali can be maintained.

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