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Spatial Management to Enhance Tourism Industrial Ecology and Natural Resources Conservation: A Case Study of Kakas Sub-district, Lake Tondano, North Sulawesi

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Abstract

Lakes throughout the world recently are facing serious problem which lead to its extinction. Integrating conservation and tourism in lakes and it surrounding area offer new opportunities for environment, development and economic growth in harmony. The aim of the research is to identify spatial composition of an area adjacent to Lake Tondano as a basic model of tourism industrial ecology. The study was set up at Kakas as one of the villages which is located adjacent to Lake Tondano. The result of the study shows that the model area adjacent to Lake Tondano acting as a sustainable rural destination consists of several land uses, including shrubs, paddy field, orchards, traditional plantation, and settlement with a total area of c.a. 27.80 km². Based on its characteristic, tourism in the study site should be projected in a form of rural tourism. There are natural and cultural capitals found in the study area, and their existence principally represents the potential resources for tourism development. These potential attractions are spatially distributed in three

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areas, which can be linked through a triangle diamond model to meet a sustainable and competitive tourism industrial area. The opportunities of such concept also come to the existence of a corridor which is able to link each point area to become a single and integrative tourism destination. Challenges for the tourism industrial ecology in Kakas, however, lie on its ability to optimize resources, while at the same time minimize potential negative impacts to the environment, especially Lake Tondano.

Keywords: Spatial mapping, Sustainable and competitive tourism, Lake conservation, North Sulawesi

Introduction

Lakes play an important role in hydrological processes and support numerous biodiversity. Many lakes are harbor of endemic fish species and crucial sites for migratory birds (Hairston and Fussmann, 2002). Socio-economically, many people in developing countries depend on the lake ecosystem to generate small-scale fisheries which becomes an important source of income for local community. While lakes have been identified to play an important role on earth's life, many studies report that lakes and their surrounding areas are one of the most threatened ecosystems on earth. According to scholars, many lakes ecosystem in the world are nowadays facing serious problems which lead to their degradation and extinction (Zacharias and Zamparas, 2010). Rapid development in areas surrounding lakes contributes significantly to lake degradation. The strategy to enhance lake conservation, therefore, should take into account areas surrounding lakes as an integral part to be developed sustainably.

The potential integration of tourism industry and lake conservation is widely promoted in the world (Infield and Namara, 2001; Sah and Heinen, 2001; Solossa *et al.*, 2013). These

opportunities provide new scenarios for many lakes in Indonesia, including Lake Tondano in North Sulawesi. Lake Tondano is one of the natural resources in Minahasa Regency, North Sulawesi, which is recently under serious threats. Rapid sedimentation, invasion of exotic plant species and pollution has become the most crucial problems to Lake Tondano. From the perspective of tourism, however, Lake Tondano is one the interesting sites in North Sulawesi which is commonly visited by domestic tourists (Hakim *et al.*, 2012). This phenomenon provides opportunities to uses tourism industry as a key to enhance lake conservation and local economic development. In the political context, using tourism issues to support Lake Tondano is relevant to the recent provincial government policy to promote North Sulawesi to become one of the famous tourism destinations in the world. North Sulawesi is one of the important nature-based tourism destinations in Indonesia. North Sulawesi has abundance natural resources for tourism attraction ranging from coastal areas to active volcanoes. As far, Bunaken National Park and its surrounding small islands, which are rich in coral reefs, have been visited by both national and international tourists. It is estimated that in the future tourism will grow significantly in many areas in North Sulawesi

(Hakim *et al.*, 2012; Pangemanan *et al.*, 2012; Andaria *et al.*, 2013).

Developing areas surrounding Lake Tondano as a specific tourism industrial area will facilitate integration models of tourism and conservation. Tourism industrial area, which is managed in sustainable principles, will allow lake conservation as well as local economic development. Scholars point out that there are numerous approaches to meet destination sustainability, namely economical, sociological, political and ecological approach. In North Sulawesi, Pangemanan *et al.*, (2012) argues that pricing policy could be a significant economical tool to ensure tourism sustainability in Bunaken. In another study, Andaria *et al.*, (2013) confirms that community involvement is one of the important aspects in nature-based tourism in Bangka Island. The spatial model, however, is absent. In perspective of spatial planning, defining the spatial pattern of landscapes has been recognized as a success for land and space management.

Spatial planning to manage a region has been proposed by numerous authors and agency as a tool to achieve sustainable tourism industrial area (Andrews, 2002; Bao *et al.*, 2002; Papageorgiou and Beriatos, 2011; Dede and Ayten, 2012). Tourism as one of the fast growing industries recently is addressed to meet its sustainability which puts ecological, economical, and social aspect as its integral components to meet destination sustainability. In an industrial context, it is one of the manifestations of industrial ecology which recently revived intensive

discussion (Jelinski *et al.*, 1992; Lifset and Graedel, 2002). Recently, the principles of industrial ecology have been applied to tourism destination management (Schendler, 2003). According to Kuo *et al.* (2005), the industrial ecology approach in tourism industry is considered one of the crucial aspects in the future of tourism industry.

Spatial planning provides benefits to minimize environmental degradation and reversely increase the efficiency natural resource uses. In tourism destination systems, the spatial planning facilitates scenarios to protect biodiversity and environment from tourism pressures. Spatial planning principally allows tourism attributes connectivity and, therefore, creates integrative destination. Overall, spatial planning contributes to the spatial design to meet space carrying capacity in destination management systems. In North Sulawesi, however, such research was absence. The aims of the research are, therefore, to identify spatial composition of a particular area in Kakas as basic information to design and develop sustainable tourism industrial area.

Methods

Study site

The research was done at Kakas sub-district of Minahasa Regency, North Sulawesi. The climate of the area is wet and humid with annual rainfall of c.a. 2,000-3,000 mm. Daily temperature recorded was 21° to 23° C, with the humidity of c.a. 87 – 92%. According to Schmidt and Ferguson climate classification, Kakas can be classified into a permanently humid area (Whitten *et al.*, 1987). This area

is located adjacent to Lake Tondano as one of the nature-based tourism destinations in North Sulawesi. The recent status of Lake Tondano, however, is reported to be facing serious problems leading to its damage. Such disturbance has been reported to be associated with the human activities in areas surrounding the lake. Tourism has been growing in Lake Tondano, but there is a few comprehensive planning and evaluation on the practices and impacts of tourism (Hakim *et al.*, 2012). Geographically, Kakas is located at 500 – 700 m asl. These areas are rich in term of natural and cultural resources which are potential to be developed as a tourism attraction. Local people are traditional farmers. Some of them are developing small scale fisheries in Lake Tondano.

Methods

The area mapping to define industrial ecological sites consists of four steps namely data acquisition, pre-processing, analysis and map-product generation. In this study, topographic map of Minahasa District from BAKOSURTANAL was used to generate the study area. The topographic map was scanned and imported to the computer system for a further analysis using GIS software. In this study, tourism resources exploration was initiated with literature reviews and interviews with tourism stakeholders. Official documents related to tourism development in Minahasa regency was studied and the potential of tourism attractions, which were noted in the documents, were documented. Tourism stakeholders in Kakas (i.e. local governmental officials, restaurant and hotel

owners) were interviewed in order to identify the potential tourism attractions in Kakas. Field survey was done to verify the study area and to check the boundaries of the study area. GPS was used to collect geographical data of tourism destination components and attributes, including geographic position of potential tourism attractions. Data were stored in a computer system and were processed using ArcView.

Result and Discussion

Ecological Features of the Model Area

The tourism industrial model area in this study occupies an area about 27.81 km². Compared to the total area of Kakas sub-district, the modeled tourism industrial area covers about 0.017% of the total area of Kakas sub-district (total area is c.a. 162, 666 km²). The majority of Kakas sub-district is dominated by forest (BPS Kakas, 2011). It is a common phenomenon in eastern Indonesia, including many parts of the districts and regencies in Sulawesi Island.

Physically, this study site consists of several land uses category, reflected that the area has been used intensively by humans (Table 1 and Fig.1). Paddy field and family plantation, which are managed in traditional systems, are dominant; this indicates that the model area was a traditional rural area. According to Whitten *et al.* (1987) the economic income of Minahasa ethnic groups depend on the plantation and mixed agriculture practices. The comprehensive agroforestry system in Minahasa was less reported, but it was estimated that Minahasa regency is the home

of numerous agroforestry practices. In North Sulawesi, typical agroforestry land was abundance with numerous trees and crops. Among the trees and crops, Aren palm-based agroforestry (*Arenga pinnata* (Wurmb

Merr.) was the main traditional agriculture system. The species produces *nira* sap which can be processed into sugar (Lay and Heliyanto, 2011).

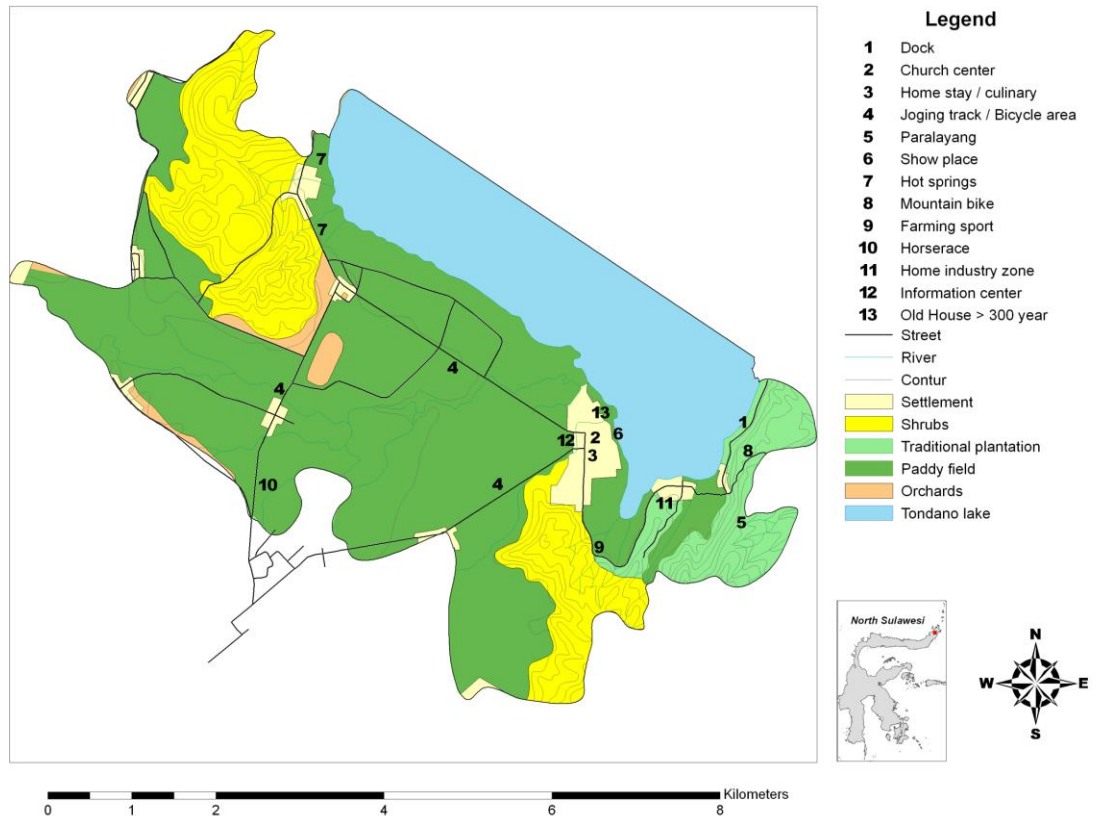


Fig 1: Land Uses of Study Site

Inside the model area, there are barren lands which occupy about 22% of the total area. This area was dominated by numerous shrubs, with *Imperata cylindrica* (L.) P. Beauv. as the main invasive species. Another plant species found in the barren land including *Calliandra emarginata* (Humb. & Bonpl. ex Willd.) Benth. and *Alpinia* spp. In the area, *Gigantochloa apus* grew patchy. This figure represents the past forest disturbance by human. In the past decades, forest concession is one of significant

problems in many forest areas in Indonesia, including North Sulawesi (Whitten *et al.*, 1987).

Settlement area was home for numerous exotic plants species. Most of the area introduced to the house for ornamental plant purposes. It included *Bougainvillea spectabilis* Willd., *Cordyline fruticosa* (L.) A. Chev., *Dracaena* spp., and *Aglaonema* spp. There are also numerous kinds of banana (*Musa ×paradisiaca* L. and Areca-nut-palm *Areca catechu* L. As far, there was

no evidence on the garden intensifications to enhance economic income. In rural areas in Java, many plants are planted in home garden as an additional income source. Local houses with their garden are basically able to be developed into tourism homestay. It is principally important to generate local economic earning from tourism industry (Zeppel, 2006).

Lake Tondano (c.a. 4.680 Ha) is one of the crucial components in this model tourism industrial area. Covering 8% of the Tondano's watershed area, Lake Tondano is one of the important ecosystems in North Sulawesi. About 35 rivers flow to Lake Tondano. Among them, three rivers, namely

Panasen River, Ranoweleng River, and Leleko River, have been identified to contribute to lake sedimentation and eutrophication (Kumurur, 2002). Recently, invasion of water hyacinth (*Eichhornia crassipes* (Mart.) Solms.) and pollution caused by human activities have been heavily damaged the lake. Another exotic species in the lake are *Anodonta woodiana* Lea and *Pomacea canaliculata* Lam. In the perspective of tourism destination management, the conservation of lake as one of the crucial natural resources for tourism attraction is important. Therefore, providing serious attention to the lake conservation is crucial.

Table 1: Land Uses Classification in the Model Area

No	Land uses category	Area (Km ²)	Percentage to the total area (%)	Area description
1	Shrubs	6.16	0.22	Degraded land dominated by <i>Imperata cylindrica</i> . There are no significant agricultural activities recorded in this area. Hilly area with sharp slopes.
2	Paddy field	17.49	0.63	Paddy fields which are managed in traditional ways (called <i>Mapalus</i>). Flat area and few terrace systems.
3	Traditional plantation	2.15	0.08	Traditional plantation with numerous plant species, including Aren palm, bamboo, coconut, cloves, vanilla and numerous fruit.
4	Settlement	1.40	0.05	Local settlement dominated by traditional tribes (Minahasanese). Many old and traditional Minahasanese buildings are still found.
5	Orchards	0.60	0.02	Small orchards as a place to cultivate daily use vegetables such as corn, piper, cassava, tomatoes, onion and other crop species
	Total area	27.81		

The Models Development for Tourism Industrial Ecology Area

The physical and ecological data which were presented above indicate that Kakas is a rural area. Consequently, a rural tourism approach should be promoted in sustainable sound with the objectives of increasing environmental conservation, generating new local economic activities and providing jobs for local people. In many parts of the world, tourism is one of the rational options for rural development (George *et al.*, 2009). Tourism is one of the important strategies to diversify agricultural product.

From the point of spatial context, the rural capitals arrangement to meet sustainable development is important. It is particularly important as rural is home of numerous biodiversity. Rural also provides a buffer function to minimize human negative impacts to forest ecosystem. From the point of socio-ecological context, rural is one of the most fragile sites in the worlds. These

implies that spatial management of rural for any purposes and activities is crucial. Gunn and Var (2002) point out that spatially tourism destinations consist of basic elements namely gateway, community, corridor and attraction complex which should be managed in an integrative vision. Kakas completely consist of such destination components. The weakness, however, is that such components is badly or even less managed. Each component, both spatially and functionally, seems to occur as an independent aspect. Since the component's connectivity is an important factor in the integrative system, identifying component and linking each component to build a comprehensive and integrative system is crucial. According to scholars, one of the characteristic of industrial ecology is integrative network which is able to run stable systems (Andrews 2002; Gunn and Var, 2002). This requirement implies that developing a triangle diamond in Kakas development could be significant (Fig. 2).

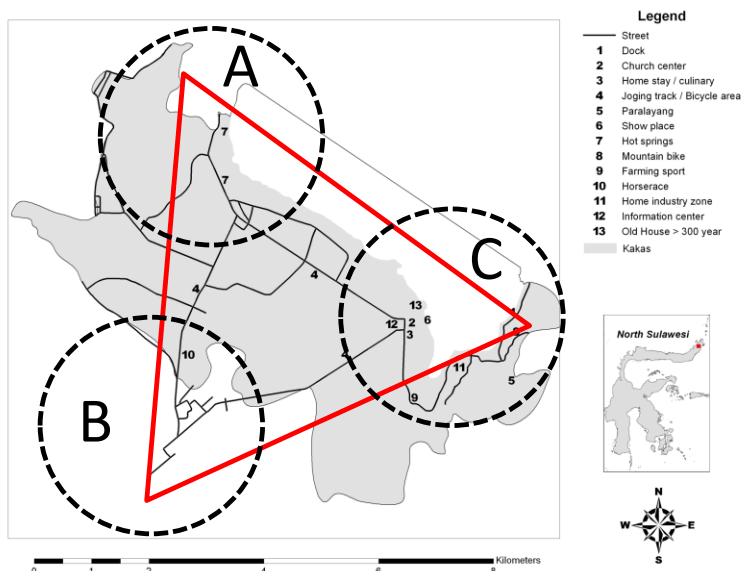


Fig 2: The Distribution of Tourism Potentials in the Triangle Diamond Perspective

Three gateways to access Kakas, namely Langowan (Area A), Remboken (Area B) and Eris (Area C) were identified in this study (see Fig.2.). There are small villages in the gateway point, namely Passo (notation A in Fig.2), Tountimomor (notation B in Fig.2) and Kakas-stat (notation C in Fig. 2). In those areas, the distribution of community settlement was patchy. The highest population density was found in Passo (752 people/Km²), followed by Kakas-Stat (480 people/Km²), and Tountimomor (159 people/Km²). The local dwellers in those villages were Christian Minahasanese (BPS Kakas, 2011). These villages were connected to each other by rural roads. There is as long as 8.2 Km rural road from Passo to Tountimomor, 9 Km rural road from Passo to Kakas-stat, and 5.7 Km road from Tountimomor to Kakas-stat. These road infrastructures are basically constructed by hot mixed materials with regular maintenance by local government and society participations. According to Baud-Bovy and Lowson (2002), these infrastructures are meeting to the basic requirement standards of destination development.

The literature survey, stakeholder interviews, and field survey confirm that Kakas is the home of diverse tourism attractions. Kakas is endowed by abundance tourism attractions, such as hot springs, lakes, agricultural landscapes, traditional settlement, plantations, and social-cultural events which are able to be developed as tourism

attractions. The rural tourism essences come from several features of agricultural phenomena, both social and physical. For instance, Kakas has huge traditional landscape attributes, such as old settlement and churches that are embedded in paddy field background. The typical landscapes of Kakas represent Minahasanese cultural landscapes which are able to be integrated as tourism destination planning and development. In Bali Island, the Balinese cultural landscapes provide significant future to indigenous landscapes as a tourism attraction (Hakim *et al.*, 2009). In Kakas, these attractions are distributed in several points and can spatially be clustered into three groups (Fig. 2). These clusters can be drawn as follows:

- Cluster A: there are two hot springs and pools as a basic attraction. The additional potential attraction encompasses traditional settlement as well as local culture and tradition.
- Cluster B: in the past, this area was addressed to become a sport center, including horse races. Recently, the horse race activities are absent, but several horse race infrastructure is still available. This area is also endowed by some spectacular landscapes which are potential to be promoted as tourism attractions.

- Cluster C: an area with abundance potential natural and cultural attractions. There are historical assets (i.e. old churches, old traditional houses), traditional markets, and home industries in the cluster. There is also a water-based tourism attraction in cluster C.

The basic schema of the triangle diamond model addressed here is to connect the three points of attractions into a single destination. In the North West part, the hot springs can be the main attraction. As far, south west area has few attractions. Many attractions and facility are located at the north east. These three spots can be joined by rural corridors (Fig. 2). The development of each point should be balanced and meet its ecological aspect. As a consequence, the North West areas and south west areas should be developed by creating specific programs and tourism attractions, while in the North east; development should be controlled and addressed to meet ecological sustainability. These will be linier with the principles of destination sustainability (Lee, 2001; Gunn and Var, 2002; Kuo *et al.*, 2005).

The success of triangle diamond system depends on road availability and quality. In Kakas, rural roads as tourism corridors so far are in good quality to facilitate visitors' mobility and access to tourism attractions and accommodation. The corridor plays an important role not only to link attractions but also to distribute visitors equally. It becomes

the fundamental strategy in carrying capacity management, particularly in small nature-based tourism area with limited resources. Corridor establishment will help to enhance tourist flows in particular destination systems and, therefore, reduce potential impacts to particular sites. It is particularly important due to the fact that concentration of tourism in a single area lead to vegetation degradation, wildlife habituation, land deterioration, and pollution (Gunn and Var, 2002).

Towards Tourism Industrial Ecology

An industrial ecologist argues that systems should be developed following ecological principles (Kuo *et al.*, 2005). Lee (2001) points out that four approaches, namely implementing Local Agenda 21, Environmental Management System (EMS), eco-labels, and cleaner production principles, are the fundamental aspect towards tourism industrial ecology in a particular area, including Kakas. Principally, the aim of such approaches is to provide guideline to meets sustainable uses of resources, including land management. It principally becomes important because spatial planning is quite often confused with numerous stakeholders and community motives. The spatial planning, therefore, comes to accommodate numerous aspects and interests into one strategy (Turner *et al.*, 2001). These perspectives should be introduced in Kakas area with collective support from community, stakeholders, and local government.

Fig 3: Conceptual Models of Tourism Impacts in Kakas. Arrow Indicates Positive Impacts, and Dot Arrow Indicates Negative Impacts

Minimize environmental impact must become the focus of industrial ecology. It is particularly relevant in Kakas. Based on field survey and interviews with tourism stakeholders in Kakas, there are several

important actions that should be implemented (Table 2). In such management, however, the participation of tourism stakeholders and community should be facilitated.

Table 2: Management Approach of Land Uses

No	Land uses category	Area (Km ²)	Management approach
1	Shrubs	6.16	Improved and transformed into productive land to support tourism destination.
2	Paddy field	17.49	Minimizing pesticide use, introducing integrated pest management control, promoting organic agriculture, and enhancing sustainable practices traditional farming will contribute to the proposal of paddy field as a tourism attraction.
3	Traditional plantation	2.18	Improving plantation quality, promoting agro-forestry approach in plantation management, supporting traditional plantation as a tourism attraction (i.e. farm trip program)
4	Settlement	1.40	Preserving old traditional buildings, strengthening local cultures and traditions. Improving settlement environment, including sanitation, home garden quality.
5	Orchards	0.60	Improving orchards productivity to support tourism industrial area

As a sustainable ecological system, each landscape component of the tourism industrial area in Kakas should be able to contribute positive impact to the whole systems. In Kakas, it is particularly relevant due to rapid land degradation affecting lake existence in the future. The degradation that leads to ecosystem instability of a particular area will contribute to negative impacts to another area in the system. This is principally important in landscape ecology (Turner *et al.*, 2001).

Conclusion

Sustainable tourism nowadays becomes the important aspect in tourism industry. Many

approaches to develop such model have been implemented, but few are related to the application of spatial planning. In the perspective of Lake Tondano conservation, enhancing sustainable human economy and activity in the area adjacent to the lake ecosystem is crucial. Spatially, the present structures of Kakas’ areas for tourism development purposes consist of gateway, corridors, community, and complex attractions. The research confirms that typically spatial planning is able to accommodate the needs of tourism destination development, especially in order to meet tourism industrial ecology. Spatial planning is able to map tourism attractions

and to model corridors systems which become the basic fundamental aspect in tourism destination planning. In Kakas, potential tourism attractions can be linked through the triangle diamond model to meet a sustainable and competitive tourism industrial area. The existing corridors linking each point area basically support tourist movement, but ecological conservation of many land categories should also be promoted comprehensively with the objectives of improving destination quality.

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