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BIODIVERSITY CONSERVATION, COMMUNITY DEVELOPMENT AND GEOTOURISM DEVELOPMENT IN BROMO-TENGGER-SEMERU-ARJUNO BIOSPHERE RESERVE, EAST JAVA

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Abstract: The objective of the paper are to identify levels of bio-geodiversity of Bromo-Tengger-Semeru-Arjuno area, describes local community and factors triggering biodiversity disturbance and declines, and establishes recommendations for geotourism development in Bromo-Tengger-Semeru-Arjuno Biosphere Reserve, Indonesia. This study cundected a series of field observation, secondary data analisys and interview at the local and regional levels. Result shows that Bromo-Tengger-Semeru-Arjuno has high biodiversity and is the most diverse highland region in East Java Province. There are a large number of flora-fauna and geological phenomena, reflecting the importance of biodiversity conservation and geotourism development in this area. While there are many positive impacts from tourism, there are also environmental problems. A number of identified problems encompass unsustainable agriculture practices, illegal hunting, illegal logging, forest fire, illegal plant collections and tourism. A large number of visitors at some attraction locationsare a critical issue in the biosphere reserve area. The development of other tourist spots has been important to reduce human impact to the biophysical environment of biosphere reserves. The challenges facing the development of sustainable geotorism in Bromo-Tengger-Semeru-Arjuno Biosphere Reserve are to find a balance between conservation and tourism as well as involve local people as active participants in tourism development.

Key words: Sustainable tourism, Sustainable development, Mountain conservation, Geotourism, Volcanoes.

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INTRODUCTION

In Indonesia, the development and economic growth from 1970 to 1997 have had a major impact on the forest. According to statistical data, rapid removal of the forest appears to have occurred after 1997. From the perspectives of forest conservation, the consequences

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of the economic crisis at the end of 1997 should not be underestimated. The major areas suffering the greatest losses in forest cover were the lowland forest areas (Angelsen, 1995; Sunderlin, 1996; Departemen Kehutanan, 2002). In the northern area of East Java many mangrove forests have degraded and been converted into shrimp aquaculture and human settlement. Scholars have pointed out that many animals and plants are susceptible to the negative impact of forest degradation. In the lowland mountain forest, some species have disappeared during the last decades, including Javan tiger *Panthera tigris sondaica* and endemic palm *Pinanga javanica* (Whitten et al., 1996).

While biodiversity habitats have been declining in lowland areas, the highland areas have remained less disturbed. The highland ecosystems of East Java contain a large amountof biodiversity (Whitten et al., 1996; Van Steenis, 2006). There are two significant highland and mountainous forest protected areas, namely Bromo Tengger Semeru National Park and R. Soerjo Grand Forest. The contribution of such areas in the highland and mountain biodiversity conservation has been significant (Departemen Kehutanan, 2002). There is, however, no integrated management strategy for these two protected areas. Most of the studied documents and literature have evidenced significant conservation management problems. Progress in conserving mountain biodiversity has been partial. These highland ecosystem conservation efforts faces some challenges, including funding for research and a protection program. There is also alack of public consensus for forest protection and conservation. Both protected areas alone would not have been capable of financing a mountain forest conservation program.

Recently, there has been strong interest and concern for tourism, local community development and forest sustainability at all levels in East Java. In such a case, the development of the biosphere reserve has been viewed as one of the significant tools to promote regional sustainable development (Cochrane, 2006). Bromo-Tengger-Semeru-Arjuno Biosphere Reserve (BTSA-BR) was firstly proposed by East Java Provincial Government in 2014 and approved by UNESCO in 2015. The biosphere reserve concept was introduced and prioritized in order to build integration and understanding among local, provincial, central government levels and local stakeholders. This new biosphere reserve consists of two protected areas: Bromo Tengger Semeru National Park and R. Soerjo Grand Forest area. The reserve aims to conserve eastern Java's biodiversity from extinction and to improve the socio-economic welfare of communities living within the BTSA-BR boundary in sustainable ways. In this context, the role of the biosphere reserve is to encourage sustainable regional development (East Java Forest Office, 2015).

Scholars have pointed out that there is a relationship between biodiversity, community and tourism development. This relationship is a complicated and sensitive process, but important for sustainable development (Gössling, 1999; Eagles et al., 2002; Kiss, 2004). Geotourism has been viewed as important for tourism (Pralong, 2006; Piacentini et al., 2011; Cappucci et al., 2015). In BTSA-BR, however, such issues have been poorly discussed. Geotourism has been documented as one of the important strategies to support biodiversity conservation, but its relationship with biodiversity and local people is poor. The database system was poor and biodiversity was not mapped comprehensively. There are also poor understandings and documentation related the contribution of local people to biodiversity. In the context of sustainable tourism development, these issues have been identified as important. This paper attempts to describethe biodiversity of the new biosphere reserve in East Java and examine the relationship between society and the biosphere reserve. We then identify a human aspect which has led to a biodiversity decrease in the BTSA-BR area. The paper ends with a synthesis of geotourism development agendas of the biosphere reserve.

METHODOLOGY

This study utilizes both primary and secondary data collected from January 2014 to June 2015. A review of these documents aims to provide valuable insight into the value of BTSA-BR biodiversity. Biodiversity data related to species diversity and conservation status were collected through document examinations. The purpose was to describe and illustrate the biodiversity value of the study sites. The secondary data collection was done in Bromo Tengger Semeru National Park office and R. Soerjo Grand Forest office in Malang, East Java. Additional data were obtained from the Forestry Office of East Java Province in Surabaya. Primary data were collected from semi-structured interviews with the head of the national park, head of R. Soerjo Grand Forest, head of forestry office of East Java Province, head of PERHUTANI, NGOs and community elders. Statistical reports and documents related to the management plan for Bromo Tengger Semeru National Park and R. Soerjo Grand Forest were assessed to determine the biodiversity status of the study area. The semi-structured questions were designed in order to generate information and responses regarding the following themes: (1) levels of biodiversity in the study area, (2) local community and factors triggering biodiversity disturbance and declines, and (3) recommendations for geotourism development in biosphere reserve area. The interviews took place at the national park office, grand forest office, village office and local working group secretariat. Interviews were also conducted with local people in homes and orchard fields. Interviews were conducted in *Bahasa Indonesia* and Javanese language. Besides interviews, field observations were carried out at some locations and villages in the periphery of the biosphere reserve area. Data was analyzed descriptively.

RESULT AND DISCUSSION

Biodiversity of biosphere reserve area

The BTSA-BR is located in the heart of the East Java Province. The biosphere reserve represents two mountain biodiversity hotspots (Bromo Tengger Semeru National Park and R. Soerjo Grand Forest Park) and some famous nature-based tourism destinations (Figure 1). It was selected as a biosphere reserve because it is considered to be one of the most bio-geo-ecologically important sites. From the perspectives of management practices, the BTSA-BR has been divided into three zones, namely core zone, buffer zone and transition zone. The zoning was established on biodiversity and ecological aspects, official forest management and land tenure consideration. The core zone consists of two main protected areas: the Bromo Tengger Semeru National Park (50,276.20 ha.) and R. Soerjo Grand Forest Park (27,868.30 ha.). This area constitutes the primary forest area for mountain biodiversity conservation. Surrounding the core area are buffer zones (96,349.56 ha.). It is mainly a protected forest and production forest under PERHUTANI (a state-owned enterprise in the forestry sector) management, community forest garden, monoculture orchards, and rural settlements. The transition zones include rural and suburban areas of Malang, Pasuruan, Probolinggo, Lumajang, Mojokerto, Jombang, and Kediri regency and Batu City. The residents of these areas interact in various ways with natural resources of the buffer and core zones (East Java Forest Office, 2015).

Ecologically, the core and buffer zones of BTSA-BR show great variation in altitude, topography, soil and vegetation. There are three active volcanoes inside the core zone, namely Mt. Semeru (3,676 m asl), Mt. Bromo (2,392 m asl) and Mt. Welirang (3,100 m asl). The core area of the biosphere reserve is the hotspot of mountain biodiversity. The number of identified higher plants species in BTSA-BR forest is estimated at 800 species. About 226 orchid species were found in Bromo Tengger Semeru National Park. About 137 bird species were recorded in the park area. The dominant vegetation in the core area consists of a

humid mountainous tropical forest. The vegetation varies from lowland tropical forest to sub-alpine. These may occur as a consequence of altitudes and local climates of the places. Structurally, the forest vegetation of BTSA-BR is multi-layered. Each layer is an important habitat for different animals and epiphytes species. The layers are distinguishable mainly on the basis of plant and vegetation structure (Whitten et al., 1996; Van Steenis, 2006).

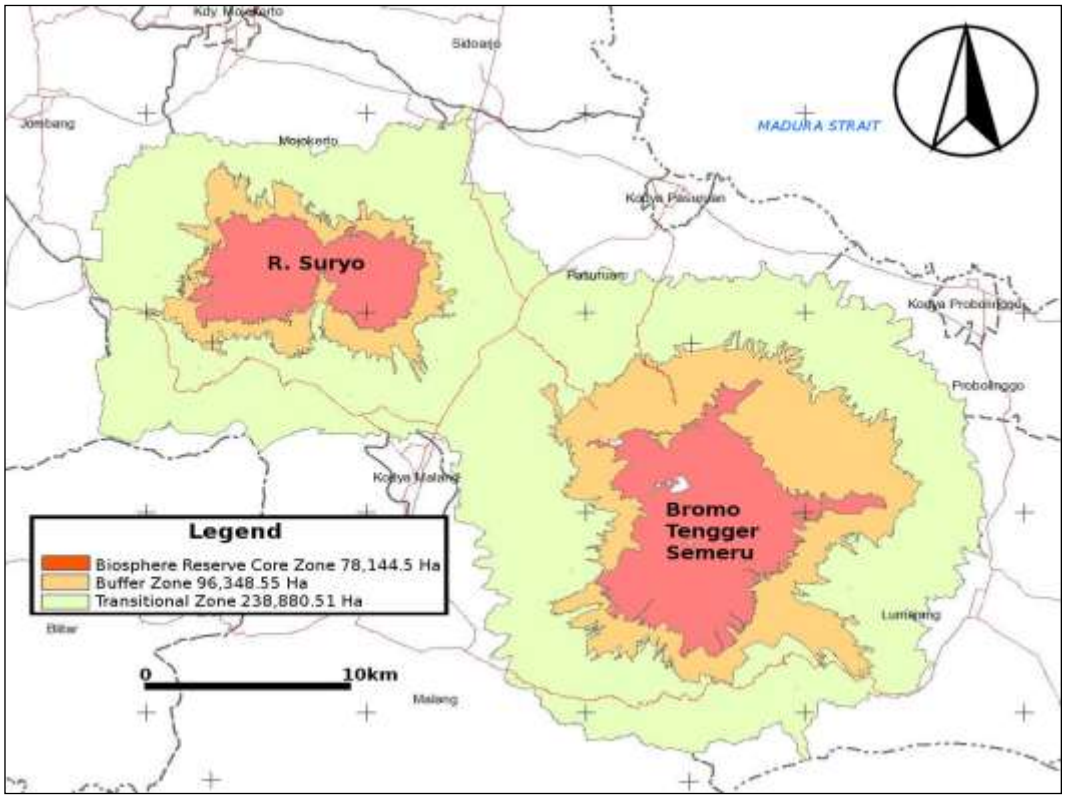

Figure 1. Map of Bromo-Tengger-Semeru-Arjuno Biosphere Reserve

The mountain forest of BTSA-BR can be classified into three forest categories, namely lower mountain forest (1200-1800 meters), upper mountain forest (1800-3000 meters) and subalpine zone (area beyond 3000 meters). The lower mountain forest provides habitat for a rich variety of mammals, including *Macaca fascicularis*, *Manis javanica*, *Mydaus javanensis, Rusa timorensis, Felis benghalensis, Muntiacus muntjak, Panthera pardus, Tupai javanica,* and *Herpestes javanicus*. The lower mountain forest vegetation consists of numerous plant tree species, including *Artocarpus elasticus*, *Erythrina subumbrans, Kleinhovia hospita, Bischofia javanica, Toona sureni, Spondias pinnata* and 23 species of *Ficus*. There area wide range of plants associated with the industry, including *Agathis dammara*, *Altingia excelsa, Cinchona pubescens, Cinnamomum burmanni,* and *Swietenia macrophylla*. BTSA-BR is one of the most important orchid centers in Java Island. The lower mountain forest on thesouthern slope of Mt. Semeru is home to some endemic plant species such as *Malaxis purpureo nervosa*, *Grammatophyllum* spp., *Meleolawetteana*, and *Liparis rhodochila* (Van Steenis, 2006; B.T.S, 2015).

The upper mountain forest contains a wide range and number of plant species. The upper mountain forest contains a number of endemic orchids, including *Appendicula imbricata and Hebenaria tosariensis*. The humidity of the area isrelatively high (90 - 97%). Between 1800 to 2200 m asl., the plant tree species are numerous and comprise many family and genera. Important plant tree species include *Acer laurinum, Acmena acuminatissima, Astronia spectabilis, Casuarina junghuhniana, Dacrycarpus imbricatus, Engelhardia spicata, Omalanthus giganteus*, *Lithocarpus sundaicus*, *Lithocarpus korthalsii*, *Macropanax dispermum*, Myrsine korthalsii, *Trema orientalis*, and *Turpinia sphaerocarpa*. These plants tree species are an important habitat for many orchids such as *Appendicula imbricata* (endemic), *Bulbophyllum lepidum*, *Bulbophyllum longiflorum*, *Calanthe zollingeri*, *Ceratostylis radiata*, *Dendrobium linearifolium* and *Eria lamonganensis* (Whitten et al., 1996; Van Steenis, 2006). In the upper mountain forest above 2200 meters, the principal tree species are *Casuarina junghuhniana*. Shrubs and grasses are dominant, including *Imperata* cylindrica, *Eupatorium riparium*, and *Dicranopteris linearis*.

The Bromo Tengger Semeru National Park is commonly known for its wide caldera and two active volcanoes, namely Mt. Bromo and Mt. Semeru. In the Tengger caldera (2100-2150 meters), the dominant grasses and shrubs are found in extensive areas including *Imperata cylindrica, Verbena brasiliensis* and *Foeniculum vulgare*. These species are probably dominant as a result of forest fires. The growth of trees in the caldera is limited by organic matter, water availability, and fire intensity. In caldera Tengger, a high risk of fire isreported in the dry season, especially during July to August. Fire is an important aspect of the ecology of Tengger caldera (Van Steenis, 2006). Four highland lakes have been found in Bromo Tengger Semeru National Park, namely Ranu Pani, Ranu Regulo, Ranu Kumbolo and Ranu Tompe (B.T.S., 2015).

The area above 3,000 meters in elevation is classified as sub-alpine. The vegetation is limited in this area above 3,000 meters. With gradual increase of altitudes, trees are replaced by shrubs and grasses such as *Imperata cylindrica, Vaccinium* sp., and *Anaphalis* spp. The sub-alpine forest consists almost entirely of grasses and ferns. In Mt. Semeru, Mt. Bromo and Mt. Welirang, the vegetation of the sub-alpine has been restricted by volcanic ash and poisonous gases from a crater due to volcanic activity. So far, the sub-alpine ecosystem has had little influenced from humans (Van Steenis, 2006).

Eupatorium inulifolium is one of the most abundant and important exotic plant species in the mountain forest. The establishment and spreads of exotic plant species is greatly assisted by degradation of the forest canopy which is ecologically caused by degradation of the forest. The invasion of exotic species may become a major limiting factor in the natural vegetation succession process. Under heavy invasion, seed germination will be reduced and followed by failure of native plant population establishment in invaded areas. Evidence of the invasion of exotic plant species is particularly found in the Ranu Pani.

Society and protected forest

The buffer zone area of Bromo-Tengger-Semeru is inhabited by the Tenggese who are distinguished from other Javanese by the traditional customs and belief system. The Tenggerese were the first people to live and use forest resources in Tengger Highland. Recently, the Tenggerese live in eighteen small villages throughout Tengger highlands, namely Ngadas-Sukapura, Jetak, Wonotoro, Ngadirejo, Ngadisari, Ledokombo, Pandansari, Wonokerso, Tosari, Wonokitri, Sedaeng, Ngadiwono, Podokoyo, Keduwung, Argosari, Ranu Pani and Ngadas (Hefner, 1990; B.T.S., 2015). The main activity of the

Tenggerese is agriculture in the highlands. The main crops are potatoes, leeks, and cabbages. The buffer zone of R. Soerjo Grand Forest is inhabited by the Javanese. The livelihoods of some people depend on natural resources found in and around the forest. In East Java, numerous studies have shown that humans contribute to biodiversity and forest disturbance. According to respondents, there is no single cause for the forest and biodiversity degradation. A number of factors contribute to forest degradation. Increasing human population and expanding agricultural fields have contributed to the rapid forest cover changes. Growing population can result in an expanding settlement area. The consequence is rapidly declining forest cover, increasing agricultural intensity, and increasing soil pollution. In Ranupani Villages, unsustainable agriculture practices are clearly having a dramatic impact on the Ranu Pani Lake and forest ecosystems (Whitten et al., 1996). According to respondents, poverty is one of the most significant triggering factors for the forest and biodiversity decline.

The issue of poverty surrounding BTSA-BR has been complex. In some instances, poverty has increased and spread from the consequences of the economic crisis in late 1997. Poverty is also linked to a lack of human resources, including lack of competency and skills. Poor human skills are influenced by a limited number of schools and education access. These conditions have been major issues for debates among academics, conservationists, national parks, the local government, and NGOs. Living in the remote mountainous environments, the Tenggerese are highly dependent upon firewood as a source of energy. The Tenggerese use numerous plant biomass for making fire, commonly including *Acacia decurrens* and *Casuarina junghuhniana*. In the past, local people collected brush and deadwood in the forest adjacent to the village. According to park rangers, this has contributed negatively to the natural plant community regeneration.

Forest land tenure conflict was found in some sites in the PERHUTANI forest area. Local people established orchards of coffee, corn and cassava. Biodiversity loss as a consequence of the forest disturbance has been confirmed by numerous authors. Conflict causes biodiversity to decrease in various ways, through (1) intensive withdrawn forest resources and (2) conversion of forest into farmland.

Humans are the prime threat to the forest and biodiversity through habitat modification and conversion, exploitation and pollutions. All interviewed informants from the forest authority claimed that forest resources are being depleted at accelerated rates, especially in some accessible areas along the boundary of the protected areas. The illegal logging of numerous valuable forest woods has increased significantly. BTSA-BR forests contain several commercially valuable timber species such as *Toona sureni*. Other important forest resources, i.e. orchids, medical plants and birds, have also become an object of protection concern. The exploitation of such forest resources can lead to the biodiversity degradation and local extinction.

So far, punishment has not been effective and enforcement remains weak. To reduce pressures on resources, some strategies have been promoted and applied to the forest management scenario in the last several years. More specifically,community-based forest management (locally called *Pengelolaan Hutan Berbasis Masyarakat* PHBM) has been implemented widely in the PERHUTANI production forest. The concept of PHBM was derived from the principles of community-based forest management (CBFM) and resources based forest management (RBFM). When CBFM was practiced in the 2000s, local communities become involved in the PHBM program. From 2001 to 2012, PERHUTANI estimates that 5,278 villages or 97% of villages in Java and Madura Island were involved in the PHBM program (Djajanti, 2006).

According to PERHUTANI officials interviewed for this study, the company has formally agreed to build collaboration and give access to the forest land to the local community for agriculture practices for a certain number of years. During the field survey, however, planting was being done with land clearing, including burning. The interviewed PERHUTANI officials pointed out that farmers have no commitment to implement community-base forest management principles or to practice sustainable farming in allocated forest areas. Attempting to grow forest tree seedlings has failed since the tree seedlings were less managed. Seedling mortality was significant.

Some notable aspects related to environmental degradation

Unsustainable agriculture practices

Unsustainable agriculture practices are a special concern. In the last decades, intensive agriculture activity has increased. Farming in Tengger highland is mainly on dryland with many orchards established onsharp sloping lands. Agricultural land in Tengger highland was managed under the monoculture system. A particular risk associated with unsustainable agriculture practices in sharp sloping lands is the massive land erosion. In Tenggerese villages, most of the inorganic fertilizer and chemical pesticides were used intensively on vegetable orchards. Numerous chemical pesticides were introduced from Malang and Surabaya to control the orchard pests. The introduction of chemical fertilizer in Tengger highland in the 1970s is a problematic agricultural practice (Figure 2).

Figure 2. Unsustainable farming practices on sharp sloping lands with intensive chemical fertilizer applications

Illegal hunting

The significance of biodiversity of BTSA-BR in the context of local and national development has been widely reported. Many biodiversity spots in BTSA-BR suffer from human activity. There was recently an official list of rare or endangered species in BTSA-BR published. Illegal hunting may play an important role in the decline of wildlife under

the international and national regulation. Conservation consideration focuses mainly on the loss of wildlife habitat. In Mt. Arjuno, conservation attention is being given to the Javan Hawk-eagle *Nisaetus bartelsi* due to rapid habitat degradation and illegal hunting. BTSA-BR is famous as an important habitat for *Nisaetus bartelsi*. Depending on its species, hunted and trapped animals are illegally sold, consumed or captived.

Illegal logging

Illegal logging is a source of forest disturbance. Many woody plant species have been exploited as timber. The major areas suffering from illegal logging were around the perimeters of the PERHUTANI forest and core area of BTSA-BR. According to respondents, residents from the rural villages in the perimeters of the forest make extensive use of natural resources, including wood. The most frequently targeted species of illegal logging include *Toona sureni* and *Casuarina junghuhniana*. Illegal loggings are increasing due to economic conditions. Orchids, insects, birds and small mammals may be suppressedwith lost canopy. The situation becomes critical with numerous plant trunks and the canopy is the habitat for endemic orchids.

Forest fire

The growth of recent forest fire intensity is also a concern for the ministry of forestry, local government, and local peoples. In BTSA-BR, forest fire has been one of the most important factors driving forest degradation. The use of fire to open orchards is practiced near forests. As a result of this practice, the number of barren lands has increased. In the rainy seasons, the barren land was invaded by exotic plant species. Numerous wildlife species are especially vulnerable to the impact of forest fire. These include large and small mammals, birds and insects. Efforts have been made to reduce forest fires, including developing local community working groups to reduce forest fire. The national park alone has often failed to control forest fire.

Ornamental and medical plants collection

The emergence of ornamental and medical plant collections poses new threats to biodiversity. The following medical plant species are commonly collected by local people: *Usnea barbata*, *Tamarindus indica*, *Alyxia reinwartti*, and *Caroxylon formasum*. Many plants produce active compounds which are used in traditional healing. There is an abundance of mountain herbs in Mt. Semeru. From interviews with Bromo Tengger Semeru National Park officials, many ecosystems in the park are acrucial habitat for medical plants.

Tourism

Tourism activity in BTSA-BR may have important environmental and social implications. According to informants, tourism activities are able to increase waste volume, posing serious threats to the terrestrial and aquatic ecosystem in BTSA-BR. The loss of biodiversity in lake ecosystems may accelerate as a result of water pollution. Tourists contribute significantly to water pollution. This is easily observed in Lake Pani and trekking corridors from Ranupani Village to Mt. Semeru. Tourism has had great consequences for the vegetation structure and diversity, especially in Tengger caldera. Lake Kumbolo was reported to be under stress from tourism forces. Very large populations of exotic ornamental plant species ar ecommonly found in Ranupani, Ngadas, Wonokitri, and Cemoro Lawang.

Geotourism in BTSA-BR

Throughout the world, geotourism has been promoted as one of the tools to support conservation and development in protected areas and geological heritages sites, including the biosphere reserve. Geotourism focuses on geological and landscape aspects as a tourist attraction (Dowling & Newsome, 2006; Farsani et al., 2011; Yolal, 2012; Lazzari & Aloia, 2014; Pletsch et al., 2014; Cappucci et al., 2015). Geo-

morphological aspects of BTSA-BR provide rich resources for geotourism development. The potential geological features include active volcanoes of Mt. Bromo and Mt. Semeru, wide sand sea caldera, highland lakes, savanna, steep agricultural land, mountain forest and alpine forest. In some places, there are still large areas of Edelweiss shrub-lands. The geological phenomena of Mt. Bromo and landscape of Tengger caldera are key tourist attractions in BTSA-BR. Over the last decade the growth in the number of tourists to BTSA-BR has been about 51.72%. The recent tourist growth opportunities within BTSA-BR have been significant. International tourist numbers to the national park have increased from 551,710 in 2013 to 570,145 in 2014.

These tourists come from at least 35 countries (B.T.S., 2015). Nearly all tourism activity occurs within the northern part of caldera, between Penanjakan point, Mt. Bromo, Mt. Batok and Ngadisari. The southern part of the caldera is a habitat for numerous wild flowers, but less utilized by tourists. In the northern slopeof Mt. Semeru, Lake Pani, Lake Regulo and Ranupani village have recently been visited by both national and international tourists. Located in the remote areas with poor infrastructure, these areas are generally only accessible using 4WD in the dry season. In the peak season, the mountain trek from Ranupani to Mt. Semeru becomes very crowded. Statistical data records that Ranupani Village was visited by thousands of tourists every year. The most common tourist activities in Ranupani area were sightseeing landscape, viewing lakes, and trekking to Mt. Semeru.

The development of tourism beyond Mt. Bromo has been a crucial issue. It is especially important as a strategy to reduce tourist stress in Mt. Bromo and its surrounding area. In such a case, potential sites for further development include the mountain ecosystem of Mt. Semeru, Mt. Arjuno, Mt. Penaggungan and Mt. Welirang, the highland lakes ecosystem, such as Ranu Pani, Ranu Regulo, and Ranu Kumbolo, the Javanese temples complex of Penanggungan, and mountain waterfalls, such as Coban Pelangi, Coban Rondo and Coban Trisula. The lower mountain forest of the biosphere reserve is one of the region's most bio-geologically diverse areas which has the potential to be promoted as a tourist attraction. The potential tourism attraction includes bio-geodiversity tour, bird-watching and farm tour with local communities surrounding BTSA-BR.

In BTSA-BR, geotourism is facing problems related to the conservation of natural resources. An important issue that requires attention is the control of the number and behavior of tourists in Bromo crater and caldera environments. A number of tourists in Ranupani area might have environmental effects, including vegetation clearing, illegal fishing and illegal flora harvesting. Vandalism continues to be aserious problem, especially in sites with abundant rock walls. Collection of Edelweiss flower is another problem. With its high number of tourists in the peak season, Lake Regulo is currently under disturbance. Eutrophication of lakes has long been a problem in BTSA-BR, especially in Lake Pani. These aspects potentially reduce the quality of the geotourism product.

Conservation and community-based geotourism development

One of the primary goals of geotourism in BTSA-BR is to foster local economic growth. According to statistical data, the presence of tourists in natural and rural areas can affect local economic growth. More than one thousand families have received income from working as a guide and other jobs related to the tourism industry. The accommodation and transportation business provides employment and income for more than five hundred families (B.T.S., 2015).

Community involvement and development are essential to the planning development of geotourism in BTSA-BR. In some areas in BTSA-BR, the support for

collaboration in the initiation and management of sustainable tourism practices appears to be growing. With funding from the Indonesian government and several donors, some local NGOs have successfully initiated tourism development in a number of rural areas. NGOs have played a crucial role in educating and campaigning against some of the negative impacts of forest degradation and promoting sustainable use of resources. NGOs help local people understand, discover, and define the local community interest in development programs, including tourism (Cochrane, 2006).

The quality of biodiversity and integrity of the environment is the key feature for geotourism success. These aspects greatly influence destination sustainability, local business competitiveness and tourism satisfaction (Stokes et al., 2003; Newsome & Dowling, 2006; Piacentini et al., 2011; Chen et al., 2015). Community involvement and development should be addressed to support environmental conservation.

According to respondents, one of the crucial problems is the inadequate participation perceived by communities in the management of natural resources to create a sustainable destination. Lack of opportunities for involvement in planning, and decision making in nature conservation and geotourism development will severely reduce community respect in community-based tourism.It is especially important for local people in the Tengger highland. For the Tenggerese, Mt. Bromo and Tengger caldera ecosystems are not just mountain landscapes. According to the informal leader of a local community, Mt. Bromo and Tengger caldera are a place of sacred significance for the Tenggerese. Community development programs should be aimed at improving human skills, ranging from destination planning to guiding services. In geotourism, geological phenomena interpretations are important, and their successful service is dependent upon a wide range of knowledge and skills.

There should be consideration of skilled guide training systems that increase knowledge and competency. These should be integrated into community development planning and implementation (Erkuş-Öztürk & Eraydın, 2010). Linking geotourism development, biodiversity conservation and community development helps reduce resource degradation and increase the sustainable local economic development (Newsome & Dowling, 2006; Chenet al., 2015). Strategic planning for sustainable geotourism in BTSA-BR are necessary in this case, especially to ensure that geotourism does not threaten the geologically and biologically rich area. Effective strategic planning requires a clear vision and commitment fromstakeholders. Attention should be given to stakeholders who have numerous potential ways to support sustainable geotourism implementation in BTSA-BR.

CONCLUSION

The spectacular landscapes of Mt. Bromo, Tengger caldera and Mt.Semeru are clearly a major reason for domestic and international visits to BTSA-BR. The presence of tourists in natural and rural areas can affect local economic growth.With the increase of tourism in BTSA-BR there is also a growing environmental impact. Managing geotourism in Bromo-Tengger-Semeru-Arjuno activities requires a comprehensive understanding of the geological and socials aspects of this mountain ecosystem. Preservation of the mountain forest has beneficial effects for sustainable and competitive tourism destinations. Effective management of natural resources for geotourism in BTSA-BR in the future will depend on human resource quality, especially the local people surrounding the BTSA-BR area. Community development is a vital aspect of resource management and sustainable geotourism implementation. Interpretation in geotourism programs is crucial and should be promoted to increase tourists' knowledge and appreciation of nature.

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