

Ecotourism hazard management in South Beaches of Java, Indonesia

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Abstract. Visitors' safety is a crucial aspect in ensuring their satisfaction, and visitors' satisfaction can provide insurance for the management to obtain return visit. Identification of hazard potentials and risk assessment is needed to enable destination manager in managing tourism hazard. This research was carried out in three beaches of located on the Southern part of Java, i.e. Palabuhan Ratu Beach - Sukabumi, Suwuk Beach - Kebumen, and Parangtritis Beach – Yogyakarta, which had become tourism destinations. Literature study, field observation, and interview were used in collecting data on hazard potentials and its management, while risk assessment was used in the analysis. Rip current were found as hazard with substantial risk on the three beaches, while plunging wave was found in Suwuk and Parangtritis Beach. Transferring risk through insurance provisions had been implemented. However, increasing visitors' understanding about hazards, its risk, and how to avoid and handle the hazards should be included in hazard management of the destinations. This could be implemented through installing easy-to-understand signs, socialization, and community involvement in providing warning for the visitors. Early warning system involving tourism destination management and other stakeholders should also be developed.

1. Introduction

Visitors' satisfaction may provide assurance for return visit. One of the factors influencing visitors' satisfaction toward a tourism destination is visitors' safety in obtaining tourism experience. Hazards, which often found in tourism destination, pose a threat to visitors' safety. Hazard is defined as a course of event or physical condition that have the potential in causing death, injury, property damage, infrastructure damage, agriculture damage, environmental damage, or other types of damage or loss [1].

A research in Krui Beach, West Lampung found that current, wave, beach forming materials, heat and sun light, and sea fauna were hazard for the surfers in the area [2]. Another research in Pangandaran Beach, West Java, found rip current, plunging wave, tsunami, earthquake, tidal wave, jelly fish, sea snake, sea urchin, stone fish and macaque as potential hazards [3].

Tourism destination operator and manager should include ensuring visitors' safety and security as part of their management plan. In order to be able to manage hazard in a destination, managers should have the knowledge and data about potential hazard in their areas, which would enable them to develop management plan and effective solution to reducing the risk of the hazard, and thus creating visitors' confidence in the managers. Preventive action should be carried out in hazard management, so that the managers may be able to reduce the risk, both for visitors and for themselves, in the development of tourism in their area.



The research aimed to develop hazard management in disaster-prone tourism destination in South Beaches of Java Indonesia. Many places in Indonesia, particularly the coastal areas in the southern part of Indonesia, are prone to natural disaster such as earthquake and tsunami. Among the places are tourism destinations. Considering the beaches tourism potentials, visitors, and accident occurrences, three beaches in the southern part of Java that met the criteria were selected as research locations. The beaches were Karang Hawu Beach in Palabuhan Ratu, Sukabumi, West Java, Suwuk Beach in Kebumen District Central Java, and Parangtritis Beach in Bantul Regency Yogyakarta Regency.

2. Method

2.1. Data collection

The research was conducted in three beaches in the southern part of Java, i.e. Karang Hawu Beach in Palabuhan Ratu, Sukabumi, West Java, Suwuk Beach in Kebumen Regency Central Java, and Parangtritis Beach in Bantul Regency Yogyakarta Regency on March to April 2017. Data on physical and biological hazard potentials, ecological condition of the beach, existing hazard management, visitors' and community perception on hazard, were collected through literature and document study, field observation, and interview.

Interview was carried out to stakeholders involved in the hazard management of the destination, visitors, and residents. An acceptable minimum number of sample is 30 samples [4]. Therefore, a minimum 30 respondents each from visitors and residents in each location were selected using convenience sampling method. Snowball sampling was also used in determining respondent from the residents in identifying the occurrences of accidents and disaster.

2.2. Data analysis

Risk assessment was carried out for each hazard potentials found in the destination. A score of likelihood of accident occurrence caused by the hazard and the severity of its impact was assigned for each hazard potential. The score was determined based on information obtained from the residents, visitors, and managers. The score assigned referred to UNEP's risk assessment guideline, in which the likelihood of occurrence and severity were each categorized into five level [5]. The score assigned for likelihood of occurrence were 5 for almost certain, 4 for likely, 3 for moderate, 2 for unlikely, and 1 for rare. The score for severity were 16 for catastrophe, 8 for major, 4 for moderate, 2 for minor, and 1 for insignificant.

The risk was calculated by multiplying the likelihood and severity [5] [6]. The calculation will result in risk score that showed the level of risk. Risk level was categorized into substantial risk, moderate risk and tolerable risk [5][6]. Hazard with risk score ranging from 51–70 was categorized as having substantial risk, while score 16–50 were moderate risk, and less than 16 were tolerable risk (table 1) [3].

Table 1. Matrix of risk level [3].

	Risk = Likelihood x Severity		Severity		
			Low	Moderate	High
Likelihood	Low	$x \leq 16$	Very low	Low	Moderate
	Moderate	$16 < x < 51$	Low	Moderate	High
	High	$51 < x < 70$	Moderate	High	Very high

Risk management was developed based on risk level of each hazard potential. There are four management options for tourism managers, i.e. accept tolerable risk, transfer risk, reduce risk, and avoid risk [5] [6]. When the severity is low, and the likelihood is low, manager may accept tolerable

risk. When the severity is low, but the likelihood is high, the option would be to reduce risk. When the severity is high, but the likelihood is low, the management option would be to transfer risk. Avoid risk is selected when both the likelihood and the severity are high.

3. Result and discussion

3.1. General condition of the locations

The three beaches are located in the southern part of Java Island. However, the beaches have some features that distinguish one from the other.

3.1.1. Karang Hawu Beach. Karang Hawu Beach, part of Palabuhan Ratu Beach, is located on three village administrative areas, i.e. Cisolok Village, Karang Papak Village, and Cikahuripan Village, in Cisolok Sub-District, Sukabumi District, West Java. Geographically, it lies on 6°57'-7°25' South Latitude and 106 °49'-107°00' East Longitude. The beach obtain its name from its furnace (hawu, Sundanese language) shape coral (karang) jutting into the sea, which became one of tourists' attractions. There is a hill in which visitors carried out hiking activity, enjoying the scenery, and having pilgrimage activity (religious tourism). There is a place on the hill, believed by the locals as the throne of Nyai Roro Kidul, the Queen of the Southern Sea in Javanese and Sundanese Mythology. In addition to the attractions, the locals have traditional ceremony to celebrate 'Fisherman's day', in which they make processions and offerings of animal head to the sea. The beach is located ±70 km to the south of Sukabumi City. Accessible using private vehicles and public transportation. Quite a high number of lodgings and restaurants are available for the visitors who wanted to spend the night on the area. Visitors can swim, play sand, enjoy the scenery, fish and surf in the area, which met the criteria of two types of tourism activities in coastal area, i.e. beach tourism and marine tourism [7]. Visitor can swim, play in the sand, and enjoying the scenery in the sandy beach of Karang Hawu 1 Beach. Those who wants to surf can do it in Karang Hawu 2 Beach. Both beaches are sandy beaches. In stoney beach, there was not any activities observed. Beach with stone substrate is categorized as unsuitable for tourism activity [3]. However, the stoney beach was visited by the locals who uses the stone for building materials. The locals were the ones involved in fishing activities, while visitors from outside the area rarely involved in fishing activity.

3.1.2. Suwuk Beach. Suwuk Beach is located in Tambakmuljo Village, Puring Sub-District, Kebumen District, Central Java Province. The destination is geographically located on 7°45'29" South Latitude and 109°28'25" East Longitude. The sub-district has a distance of 36 km from the capital of district [8]. Suwuk Beach, with a status of permanent tourism object, covers an area of 20 ha that include 3 ha sandy beach. Having 0%-2% slope, there had never been any case of landslide in the area. Eventhough the surrounding area has higher slope, the area had not suffered from landslide [9]. Suwuk Beach is adjacent to Hindia Ocean, which makes high current flows in the waters of Suwuk Beach, categorized into west season and east season current. Tourism in Suwuk Beach is managed by local government, under the Youth, Sport and Tourism Agency of Kebumen District since 2011. The number of visitors had increased from 144,152 in 2011 to 454,633 in 2015. Visitors were commonly found doing activities, which include swimming in the beach, boating, sand playing, enjoying the scenery, taking pictures, riding mini train or ATV, watching video in the aircraft museum, and swimming in swimming pool. In addition, fishing can also be done in this beach.

3.1.3. Parangtritis Beach. Geographically, Parangtritis Beach is located on 8°0'39.35"-8°3'45.70" South Latitude and 110°20'47.29"-110°16'56.70" East Longitude, on the same coastline as Parangkusumo Beach and Depok Beach. Located 30 km away from Yogyakarta City, which can be accessed using both private vehicles and public transportation in 40 minutes. The area had received a high number of visits from both domestic and foreign visitors. Tourism activities in the area included enjoying the scenery of sunset and sunrise, playing in the sand, swimming, fishing, and surfing. The waves, sand dunes, and beach view become the main attraction for visitors. Like many other areas in the

southern beach of Java Island, this area was also influenced by Nyi Roro Kidul. The locals still carry out annual ceremony called *Bekti Pertiwi Pisungsung Jaladri* to express their gratitude for spiritual and physical safety, and abundant sustenance. A group had been established by the Tourism Agency of Bantul District to accommodate the community members who want to contribute in the tourism activity in Parangtritis Beach, i.e. Tourism Aware Group (Pokdarwis) of Parangtritis Village.

3.2. Potential Hazard Found

Although the same features were found on all three beaches, but not all of them have the same hazard potentials. Coral and sea urchin was found as having potential hazard only in Karang Hawu Beach, while wind and beach morphology found only in Suwuk Beach (table 2). Karang Hawu I Beach had hard coral and dead coral algae that caused cuts and stabs on visitors' feet who carelessly walked barefooted on the hard or dead coral. Sea urchin is nocturnal animals that hide in the crevices of the corals during the day and actively come out at night looking for food [9]. Therefore, visitors would likely be exposed to this type of hazard only when they carried out activities near the corals.

Table 2. Hazard potentials.

No.	Type of Hazard	Karang Hawu Beach	Suwuk Beach	Parangtritis Beach
1	Tidal	Moderate risk	Tolerable risk	No risk
2	Rip current	Substansial risk	Substansial risk	Substansial risk
3	Earthquake and Tsunami	Tolerable risk	Moderate risk	Moderate risk
4	Wind	No risk	Tolerable risk	No risk
5	Plunging wave	Substansial risk	Substansial risk	Substansial risk
6	Beach morphology	No risk	Tolerable risk	No risk
7	Coral	Moderate risk	No risk	No risk
8	Jelly fish	Tolerable risk	Moderate risk	Tolerable risk
9	Sea urchin	Tolerable risk	No risk	No risk

The wind in Suwuk Beach was categorized as weak breeze on Beaufort scale, marked by the frequent movement of tree leaves with occasional stops, which formed ripples with sharp peak that sometimes appear to be glistening like glass, with scale-like aranged ripples [10]. During March to April 2017, there had been an increase of speed from 4.35 knots to 5.79 knots, while the previous month the speed was even higher up to 7 knots [11]. There was an occasion in 2016 when the wind caused damaged to the buildings in the tourism destination rented by the community, which cause financial loss from the interruption of tourism activities. However, such cases was rarely happened. Therefore, the wind in Suwuk Beach was assessed as having tolerable risk.

Suwuk beach has a bay-shaped or basin-shaped sloping coastline. The water side was steep with a depth of 9.92-18.27 meters. Sloping coastline morphology was affected by normal sedimentation processes occurred in abundant amounts that settled along the coast [12]. The high different depth of sea on less than 1- 3 meters distance from the beach line posed hazard for the visitors. Visitors might not aware of the different depth and get drowned in the deeper part of the sea.

Tidal was found as hazard with moderate risk at Karang Hawu Beach, and tolerable risk at Suwuk Beach (table 2). Tidal may lead to the formation of steep coastal types when sea level changes are high

[13]. This was what happened in Karang Hawu Beach, which made the tidal had moderate risk. However, in Suwuk Beach, the tidal only cause low disturbance on tourism activities, which more likely causing low financial loss for the locals who has tourism-related business such as boat rent.

Earthquake and tsunami posed tolerable risk in Karang Hawu Beach, but moderate risk in the other two beaches (table 2). Earthquake in the sea may cause tsunami [14]. However, there had never been any tsunami occurrence in Karang Hawu Beach, and the case of two large earthquakes happened during the 1973-2004 near Palabuhan Ratu Beach did not cause casualties or other losses for the locals and visitors [15]. Earthquake and tsunami in Suwuk Beach occurred only on certain time due to tectonic activity and influenced by other locations. Parangtritis Beach is located on Bantul District. The district is located on the collision zone of Indo-Australia and Eurasia plates [16]. Therefore Parangtritis Beach is exposed to earthquake potentials that may cause tsunami. Though the likelihood is low, when it is happened, the severity might be high, and therefor in Suwuk and Parangtritis Beach, the risk was moderate.

Jelly fish in both Karang Hawu Beach and Parangtritis Beach was tolerable, but in Suwuk Beach it might cause moderate risk (table 2). Jelly fish can be found in abundance only on certain season, the dry season. Disturbance that it caused toward human is temporary. People who get stung by jelly fish will experience painful reaction, from itch to faint, and though rarely happened, also death. Jelly fish's sting reaction might vary for each individuals depends on jelly fish toxicity and the sensitivity of victim's body [17]. Cases was low in Karang Hawu and Parangtritis, but higher in Suwuk Beach.

Both plunging wave and rip current had substantial risk in all three beaches (table 2). Wave has varying and complex formation, causes nonstop swings of water on the surface of the sea that breaks on the shallow shore. Plunging wave is tube-shape breaking wave that curls toward the beach and has strong crushing force to the bottom of water that lift the materials [18] [19]. Two or even more repeated processes with reduced amplitude might occur depends on the acceleration flow condition [20]. Big plunging wave poses threat to the visitors and locals having activities in the beach [21].

Rip current is the current that move from the shoreline to the sea with varying distance, which can be found in abundance on the coast exposed to wave [22]. Rip current has high velocity that can reach up to 1 meter per second [18]. The current had caused a high number of casualties in various beaches, including Karang Hawu Beach (particularly in Karang Hawu 2 Beach), Suwuk Beach, and Parangtritis Beach.

3.3. *Visitors' perception and behavior toward Hazard*

Most of visitor could name potentials hazard found in the beach, which included currents, waves, and some sea organism such as coral, jelly fish, and sea urchin. They had the ability to identify more permanent hazard such as coral, which sits still on certain places. However, most of them did not have the ability to identify the occurrence of some life threatening hazard, i.e. rip currents and plunging wave.

Visitors were often found to ignore hazard signs put up by the destination managers, such as the red flags planted to mark hazardous areas for swimming or other water activities. This might be caused by the lack of risk information on the signs or warning boards and banners, or the lack of information on the signs of hazard occurrence. Signage with inadequate impact and/or unclear meaning might cause high number of non-compliance from visitor [23]. The absence of risk information in Alpen Austria Mountainous Area had made its visitors assumed that there was not any risk for them in the area [24]. Visitor might also ignore the signage due to their perceived risk of hazard. Visitors perceived that the benefit of the action was higher than the risk, they were not exposed to the hazard, and that the action was safe for them, seeing other people carrying out the action, without considering their skills and experience [25]. These showed the need of hazard and risk information for the visitors.

3.4. *Existing Hazard management*

There were existing hazard management implemented by the manager Karang Hawu Beach, Suwuk Beach, and Parangtritis Beach. Insurance provision for the visitors, included in the entrance fee, were among the management action implemented (table 3). Insurance is an option often took by tourism

destination managers to transfer financial risk to the third party, the insurance company. Destination managers or business operator who understands loss potentials that might be caused by certain hazard but do not have the physical resources to overcome the hazard will invest on insurance [26].

Table 3. Existing Hazard management.

Aspect Location	Stakeholders Involved	Existing Hazard Management
Karang Hawu	<u>Main stakeholders:</u> <ol style="list-style-type: none"> 1. Balawista (<i>Lifeguard</i>) Palabuhan Ratu 2. Tourism, Culture, Youth, and Sport Agency of Sukabumi Regency <u>Supporting stakeholders:</u> <ol style="list-style-type: none"> 1. National SAR Agency 2. Regional disaster management agency 3. Water Police Unit 4. Police Unit 5. First level health facilities 	<ol style="list-style-type: none"> 1. Installing red flag and hazard warning board to prevent visitors from carrying out activities in dangerous zone 2. Providing first aid for accidents occurrence 3. Providing insurance for visitors 4. Establishing evacuation route 5. Patrol to monitor visitor and redirect visitors away from dangerous zone.
Suwuk	<u>Main stakeholders:</u> <ol style="list-style-type: none"> 1. Youth, Sport and Tourism Agency of Kebumen Regency 2. Beach lifeguard team <u>Supporting stakeholders:</u> <ol style="list-style-type: none"> 1. Insurance provider 2. Police 3. SAR agency 4. Regional Disaster Management Agency 5. Regional Red Cross 6. First Level Health Facilities 	<ol style="list-style-type: none"> 1. Surveillance patrol 2. Red flag installment as danger sign 3. Hazard warning announcement 4. Insurance 5. Providing first aid for accidents occurrence.
Parangtritis	<u>Main stakeholder:</u> Tourism Agency Bantul Regency <u>Supporting stakeholders:</u> <ol style="list-style-type: none"> 1. Regional Disaster Management Agency of Bantul Regency 2. SAR Satlinmas Operational Area III 	<ol style="list-style-type: none"> 1. Insurance provision 2. Warning banner instalment 3. Hazard information board 4. Monitoring/surveillance patrol on certain period 09.00, 12.00, and 16.00 Western Indonesia Time.

Destination managers had installed red flags and hazard warning board or banner to inform visitor about hazard, and prevent them from doing activities in hazardous areas (table 3). However, visitors were often found carrying out activities in hazardous places, ignoring the signs. Warning boards installed in the areas had apparently attracted low attention from the visitors, due to bad condition and low readability of the signages. Re-development of warning signage might be helpful in providing information for the visitors.

Patrols were carried out by the lifeguard team of each destinations to monitor visitors and redirect them away from hazardous areas. However, inadequate number of lifeguard human resources had limited the patrol to certain time period, and during high number of visitations. The manager had also

provide first aid to help visitors in accident occurrences. The curative actions had been well-managed. In cases of accidents occurrence, the destination managers had also had cooperation with stakeholders needed, such as the SAR agency, the health facilities, and police unit. However, the preventive actions was still needed to be improved.

3.5. Hazard Management Recommendation

All four hazard management options may be applied in the destination, i.e. accept tolerable risk, transfer risk, reduce risk, and avoid risk (table 4). Accepting tolerable risk for low risk hazard such as tidal, earthquake and tsunami, jelly fish and sea urchins. Reducing risk and transferring risk would be the option for moderate to substantial risk, while avoiding risk should be employed for substantial risk.

Tabel 4. Hazard management option.

No	Types of Hazard	Risk level	Management Option
1	Wave	Substantial risk	Avoid risk, transfer risk, reduce risk
2	Tidal	Tolerable to moderate risk	Accept tolerable risk, Reduce risk
3	Rip current	Substantial risk	Avoid risk, transfer risk, reduce risk
4	Earthquake and Tsunami	Tolerable to moderate risk	Reduce risk, transfer risk
5	Wind	Tolerable risk	Accept tolerable risk
6	Plunging wave	Substantial risk	Avoid risk, transfer risk, reduce risk
7	Beach morphology	Tolerable risk	Accept tolerable risk
8	Coral	Moderate risk	Reduce risk
9	Jelly fish	Tolerable to moderate risk	Accept tolerable risk, Reduce risk
10	Sea urchin	Tolerable risk	Accept tolerable risk

In accepting tolerable risk, the managers should equipped themselves with the means necessary to aid visitors during accidents occurrence. Insurance had already implemented by the managers to transfer risk, and this action should be maintained to lessen financial burden to managers in cases of accidents. Closing the places with high risk hazards should be considered by the management to avoid the risk to visitors (table 5). However, this action only might not be sufficient enough to prevent visitors from overstepping to hazardous places. Therefore, visitor education would be essential, both in avoiding risk and reducing risk for the visitors (table 5).

Hazard and risk information and education may be provided for the visitors through interpretive program, such as roving interpretation given by the lifeguard members during their patrol, and interpretive media. Visitors showed better cognitive, affective, and behavioral outcome by the increase of exposure to interpretive media [27]. Realistic visualization of the hazard and the risk may help the community to have more understanding on hazard [28]. The locals might also be involved in providing warnings for the visitors, since the locals who spent most of their lives in the area, had more experience and understanding of the hazard and its risk. In addition, to be able to implement visitor safety best practices, the lifeguard members should be given the opportunity to increase their capacity. Training might provide the solution to improve the capacity and quality of the lifeguards in carrying out rescue and providing better services [29]. Early warning system and establishment of evacuation route (with improved signage) was the option for reducing the risk of earthquake and tsunami (table

5). Close cooperation with the Meteorology, Climate and Geophysics Agency would help in providing information on earthquake and tsunami warnings.

Tabel 5. Hazard management action.

No.	Management Option	Management Action
1	Accept tolerable risk	Providing first aid
2	Transfer risk	Providing insurance
3	Reduce risk	Visitor education; implementation of interpretation of hazard and risk; increasing lifeguards capacity; involving the locals in providing hazard warning for the visitors; implementation of early warning systems for earthquake and tsunami, and establishment of evacuation route.
4	Avoid risk	Closing the high risk area from visitors, visitor education

4. Conclusion

Karang Hau, Suwuk and Parangtritis beach in this research had common hazard with different level of risk. However, there were hazard with same risk level found in all three beaches, i.e. plunging wave and rip current that had substantial risk. Substantial risk often caused fatalities that should be avoided by the managers. Hazard management action to avoiding the risk can be conduct by closing the high risk area from visitors and by educating the visitors.

5. Recommendation

Closing the hazardous area alone would not provide much help in avoiding the risk, and therefore visitor education was also essential, both in reducing and avoiding the substantial risk for the visitors. Hazard and risk information and education may be provided for the visitors through the interpretive program, such as roving interpretation given by the lifeguard members during their patrol, and interpretive media. Re-development of signage was also a necessary option to obtain higher visitor compliance to the warnings.

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