

DETERMINING THE SUMATRAN ELEPHANT (*ELEPHAS MAXIMUS SUMATRANUS*) CARRYING CAPACITY IN ELEPHANT TRAINING CENTRE, WAY KAMBAS NATIONAL PARK, INDONESIA

Indra Gumay Febryano^{1*}, Rusita¹, Irwan Sukri Banuwa¹, Agus Setiawan¹, Slamet Budi Yuwono¹, Shinta Dewi Marcelina¹, Subakir², and Elisabeth Devi Krismurniati²

¹Forestry Department, Agriculture Faculty, Lampung University, Bandar Lampung, Indonesia.

*E-mails: indra.gumay@fp.unila.ac.id, indragumay@yahoo.com

²Way Kambas National Park Agency, Labuhan Ratu, East Lampung Regency, Indonesia.

Received: 07 September 2018

Accepted: 10 March 2019

Abstract

Sumatran elephants are one of the endangered species that are protected, and some of them have been tamed (and trained) to support tourism activities. The purpose of this study was to determine the carrying capacity of elephants in supporting tourism activities at the Elephant Training Centre, Way Kambas National Park. Data obtained through interviews and observations, followed with analysis on the carrying capacity of elephants for various tourist activities, including Elephant Riding, Tracking, Safari, Night Safari, and Full Day. The results showed that the elephant carrying capacity was still maintained, with up to 390 people per day that could be entertained by 23 elephants. The balance between the purpose of protection and elephant tourism can be achieved if the elephant carrying capacity is not exceeded. Intensive promotion and provision of adequate tourism facilities and infrastructure need to be carried out by managers of Elephant Training Centre to increase the number of tourists, moreover on special interest tours; where this will have a significant impact on increasing non-tax state revenues following the elephant carrying capacity.

Key words: conservation area, endangered species, protected area, sumatran elephant.

Introduction

The increasing number of tourists visiting national parks year after year shows how the tourism sector is progressively developing in conservation areas (Marcelina et al. 2018). The driving factor for tourists to visit national parks is for recreation and seeking knowledge, valuing wildlife, and the desire to feel a strong bond to nature (Mutanga et al. 2017). The relationship between wildlife-based tourism and

conservation is not always positive, and there are increasing concerns about the sustainability of tourism environments in protected areas (Grunewald et al. 2016).

One of the endangered species that is protected and some of which have been tamed to support tourism activities is the elephant. The study conducted by Kerley et al. (2003) shows the existence of elephants as one of the key components for attracting and offering tourism experiences that are in protected areas. Ranaweer-

age et al. (2015) argue that monitoring tourist influences on endangered species, such as Asian elephants is the vital matter. Hence appropriate action can be taken to reduce disturbances towards this wildlife. According to Febryano and Rusita (2018), the development of elephant tourism products must have specification, quality and needs to be able to provide education on the importance of maintaining the preservation of elephants, for protection and tourism to be achieved simultaneously.

One of the conservation areas that offers activities of elephants that have been tamed is Elephant Training Centre (Pusat Latihan Gajah/PLG) located in Way Kambas National Park (Taman Nasional Way Kambas/TNWK), Indonesia. Its establishment was initially intended to minimise the conflict between Sumatran elephants (*Elephas maximus sumatranus* (Temminck, 1847)) and humans. Indrawan et al. (2010) explained that IUCN had designated Sumatran elephants with critically endangered status. According to Wahyudi (2016), their population in 2013 was estimated to be only around 1970 elephants; while this figure is much smaller than the elephant population in 1980, which is approximately 5000.

Elephants that have been tamed are then trained to assist in handling elephant conflict with humans, saving animals, security patrols, and transportation equipment to support forest fire control activities. Over time, the PLG was able to attract tourists to take a closer look at the actions of elephants that had been tamed, such as: various elephant attractions, photos with elephants, following mahout (elephant handlers) activities in caring for, feeding and drinking, patrolling and observing the handling of elephant disorders and riding elephants (BTNWK 2012). Elephant Riding is a tourist activity that is in

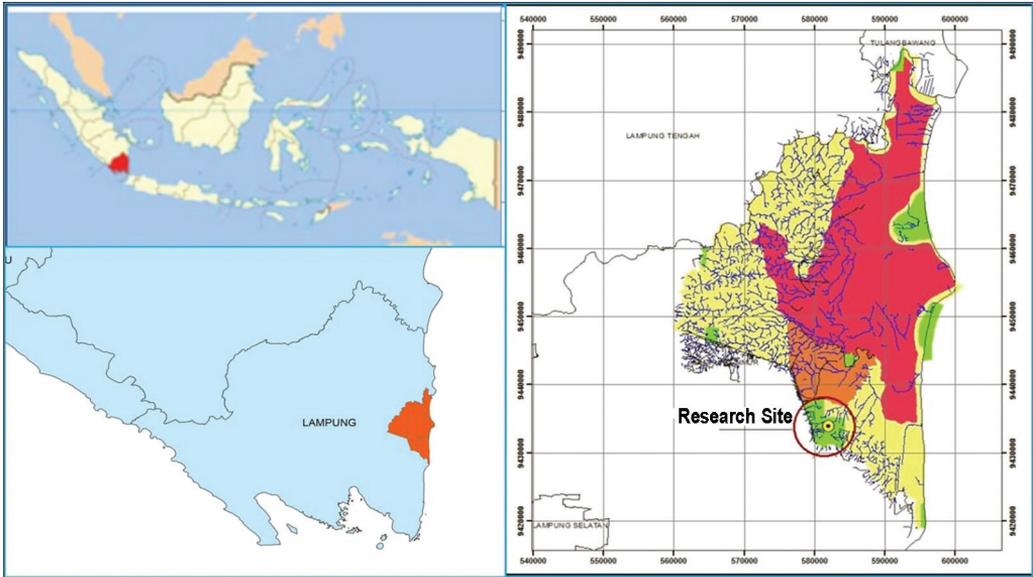
high demand by tourists, but the number of elephants used is limited and must ensure not to exceed the carrying capacity of elephants to be ridden by tourists every day.

Important ethical issues were raised around questions of animal welfare, especially definitions of acceptable and appropriate standards for working animals, along the lines of the development and expansion of elephant riding (Duffy and Moore 2011). Elephants used by humans as a means of tourism activities often experience torture (Dick 2016). The research conducted by WAP (2017) on 3,000 elephants involved in the tourism sector in several countries, namely: Sri Lanka, Nepal, several states in India, Laos, Cambodia, and Thailand in late 2014 to mid-2016 showed how three out of four elephants experience poor living conditions, such as: being chained, lack of ecological encounter, inadequate shelter, lousy food, and stressful interactions with tourists.

Operational hours and elephant mileage are influential variables in understanding the work intensity of elephants in elephant training locations in Northern Thailand (Bansiddhi et al. 2018). To maintain their existence in PLG, the carrying capacity of elephants to entertain tourists in each day must be considered. This consideration is critical, mainly as they are icons of TNWK and Lampung Province which attract tourists, both domestic and international, to visit the region. Therefore, the aim of the study was to determine the carrying capacity of elephants in supporting tourism activities at PLG TNWK.

Methods

This research was conducted at PLG TNWK, East Lampung (Fig. 1) in Jan-



Source: Febryano and Rusita (2018).

Fig. 1. Map of research site.

uary–March 2018. Data collection was done by interviews and observations. Determination of respondents for interviews was conducted by purposive sampling, namely the technique of determining the sample according to the terms or criteria set by the researcher (Arikunto 2010). Respondents were Way Kambas National Park Agency (Balai Taman Nasional Way Kambas/BTNWK) managers of 20 people, consisting of: Head of BTNWK (1 person), Deputy Head of BTNWK (1), BT-

NWK staff (4), Head of PLG TNWK (1), PLG TNWK staff (2), Head of Administration Division PLG TNWK (1), and mahout/elephant trainer (10). The data and information obtained were analysed quantitatively descriptively related to the carrying capacity of elephants used for several tourism activities including Elephant Riding, Tracking, Safari, Night Safari, and Full Day. Data analysis was performed using a modified formula carrying capacity of the Boullon Formula (1985) as follows:

Elephant Carrying Capacity = Number of Elephants × Elephant Capacity (person) (1),

$$\text{Rotation Coefficient} = \frac{\text{Time duration provided by manager}}{\text{Average time duration for 1 activity per person}} \quad (2),$$

Elephant Carrying Capacity per Day = Elephant Carrying Capacity × Rotation Coefficient (person/day) (3).

Results and Discussion

Description of research location

Geographically, TNWK area is located at 4°37'–5°16' S and 105°33'–105°54' E. In government administration, it is in Lampung Province which covers two districts, namely: East Lampung Regency and Central Lampung Regency (BTNWK 2016). The distance of TNWK from the state capital (Jakarta) is 241.6 km that can be reached within 5–6 h drive. When using an aircraft, it can be reached within 45 min from Jakarta to Bandar Lampung (provincial capital); continued with 2–3 h ride.

The TNWK area is stipulated through the Decree of the Minister of Forestry No 670/Kpts-II/1999 dated 26th August 1999. It has an area of approximately 125,631.31 ha and has a role as a natural conservation area to protect its wealth in various wildlife. The existence of these wild animals is still well preserved, especially the big mammals, namely: Sumatran elephant (*Elephas maximus sumatranus* (Temminck, 1847)), Sumatran tiger (*Panthera tigris sumatrae* (Pocock, 1929)), Sumatran rhinoceros (*Dicerorhinus sumatrensis* (Fischer, 1814)), Malay tapir (*Tapirus indicus* (Desmarest, 1819)), and Sun bear (*Helarctos malayanus* (Raffles, 1821)) (BTNWK 2016).

TNWK with its biological and non-biological wealth is a huge potential to be developed as an object of attraction for

tourists, both domestic and international. Some locations have become tourist icons that have been widely known both nationally and internationally, such as the Elephant Training Centre (PLG) with the main assets of tame Sumatran elephants and Sumatran Rhino Asylum (Suaka Rhino Sumatra/SRS) with Sumatran rhinoceros assets (BTNWK 2016). It was established on 27th August 1985, and is the location of elephant taming, training, breeding and conservation. Until now the PLG has trained around 300 elephants that have been distributed throughout the country (BTNWK 2012).

The number of tourists visiting the PLG from data of five years (2013–2017) shows an increase. In 2017 it experienced a visit increase of more than 50 % compared to previous years. The peak occurred in January and July, with an average daily visit of 213 people. The highest number was in July as it coincides with school holidays, but in June there were no tourists from abroad and only 134 people from within the country. The area is usually visited by tourists only on certain days such as Eid al-Fitr, Eid al-Adha, weekends or during festivals.

Direct increase in tourist visits has helped increase the number of non-tax state revenues (Table 1). This increase is the result obtained from tourist entrance tickets, which is IDR15,000 per person. Research by Parida et al. (2017) shows that tourism activities in India play a significant role in increasing state revenues.

Table 1. Number of tourist visits and non-tax revenue during 2013–2017.

No	Year	Domestic	International	Total	Non-tax revenue (IDR)
1	2013	13,299	339	13,638	77,934,500
2	2014	25,363	210	25,573	221,296,000
3	2015	23,405	257	23,662	311,685,000
4	2016	35,627	362	35,989	407,462,000
5	2017	77,550	392	77,942	830,422,500

Note: USD 1 = IDR 14,021.50 (5th February 2019). Source: BTNWK (2018).

Elephant carrying capacity in supporting tourism activities

The elephant is one of the icons that are very important in developing tourism at PLG. Elephant attraction is one of the tourist activities that present elephants and handlers with various skills such as dancing, playing football, and different other. This activity is minimal as it is only performed for one hour each day. Such attractions are only represented by some elephants, and if their posture is already large, they are no longer allowed to do the attractions.

In addition to the elephant attractions stated above, other tourist activities use elephants as mounts, namely the Elephant Riding, Tracking, Safari, Night Safari, and Full Day. Each activity has a different elephant carrying capacity depending on the number of elephants and the time duration provided by the manager (Table 2). There are 46 elephants at PLG TNWK; however only 23 of them are allocated in Elephant Riding activities; while the remaining five are allocated for tourist attractions. The elephant carrying capacity for overall above mentioned tourist activities is up to 390 people.

Elephant Riding is an activity for tourist to ride an elephant for 10 min with a relatively short route in the tourist area around PLG office. The capacity of each elephant is a maximum of 2 tourists per one way, therefore in each day, it can accommodate 300 tourists with 30 rotations. Most local tourists visiting at weekends prefer Elephant Riding activities compared to other tourist activities that use elephants for riding offered by PLG managers.

Tracking, Safari, and Night Safari are tourist activities riding elephants entering the roaming area that is the secondary forest around PLG. The time provided for Tracking activities is 30 min per route; while for Safari and Night Safari with a path that is further than Tracking activity the time duration provided per route is 30 min. The carrying capacity of elephants for Tracking activities is 50 people per day with a rotation of 10 times. As regards to Safari and Night Safari, the elephant carrying capacity is for up to 22 people and 13 people respectively, each with 4.5 rotations. In the three abovesaid tourism activities, each elephant is only allowed to carry one tourist and one handler in each route, to ensure the satisfaction and comfort of tourists.

Table 2. Elephant carrying capacity.

No	Type of tourism activities	Number of elephants provided by managers	Capacity of the elephant (person/elephant)	Time duration provided by managers (min)	The average time for one activity per person (min)	Elephant carrying capacity per day (person/day)
		a	b	c	d	(a·b)·(c/d)
1	Elephant Riding	5	2	300	10	300
2	Tracking	5	1	300	30	50
3	Safari	5	1	540	120	22
4	Night Safari	3	1	540	120	13
5	Full Day	5	1	540	540	5
Total						390

The Full Day is a tourist activity following elephant activities with its mahout (elephant handler) starting from morning to evening with a roaming area in the secondary forest around PLG. Various activities followed by tourists include bathing elephants in the morning and evening, feeding them in the morning before being grazed to secondary forests around PLG, and observing the behaviour during herding until walking back to PLG. The elephant carrying capacity in Full Day activity is one tourist; therefore, with five elephants available for this activity, Full Day can only accommodate five tourists with one rotation each day.

At present all tourism activities at PLG TNWK that use elephants for riding are still below the elephant carrying capacity to support these activities. The Elephant Riding itself that is in high demand by local tourists has capacity 300 people per day and is still far above the average number of tourists per day during the peak season in January and July 2017. Marsiglio (2017) states the number of tourists that can be maintained below the elephant carrying capacity significantly will help sustainable tourism management.

The main factor that may influence tourist interest the most to do Elephant Riding activity is the ticket price charged by PLG managers (Table 3). Different from the Elephant Riding activity with ticket price more affordable for local tourist,

which is charged at IDR 20,000 per person; the tourist activities such as Tracking, Safari, Night Safari, and Full Day, are preferred by international tourists despite the more expensive rates, because these four tourist activities offer a longer and further route and roaming time compared to the Elephant Riding activity, and the route has access to the secondary forest areas. Besides, PLG managers also differentiate rates between local and international tourists ranging from IDR 100,000 to IDR 300,000 gap.

The number of tourists visiting PLG TNWK tends to increase every year (Table 1). This is inseparable from manager's role who continues to promote through various media, both print as well as electronic. However, there is a concern if the number of tourists who are interested in doing Elephant Riding activities exceeds the elephant carrying capacity, it will affect the health condition and sustainability of the elephant itself. This condition certainly may have an impact on the balance between elephant conservation and tourism goals. If in the future the elephant carrying capacity is already reached, consequently the manager can limit the number of tourists in relevance with it, or the manager may also increase the ticket price. Ruggiero et al. (2012) explained the environmental impact that may arise due to the number of tourist visits could be minimised by providing alternative tourism activities.

Table 3. Ticket prices of tourism activities.

No	Type of tourism activities	Local tourists (IDR/person)	International tourists (IDR/person)
1	Elephant Riding	20,000	20,000
2	Tracking	150,000	250,000
3	Safari	250,000	350,000
4	Night Safari	500,000	800,000
5	Full Day	750,000	1,000,000

Note: USD 1 = IDR 14,021.50 (5th February 2019). Source: BTNWK (2018).

The tourism activities such as Tracking, Safari, Night Safari, and Full Day, are indeed the alternative tourism activities developed by PLG managers and focus on tourists who have special interests. They are mostly joined by international tourists because the rates are relatively expensive for the market of local ones. The research of Harmony and Pitoyo (2012) shows how tourists no longer pursue or quest for cheap offers for their tourist destinations, in contrary, they are willing to pay a high price for the quality of experience gained from their tour visits.

Current development causes a shift in the interest of tourists from natural tourism to special interest tourism, where the tour guarantees the existence and preservation of natural tourism objects and attractions. The study conducted by Rathnayake and Gunawardena (2013) at Kaudulla National Park shows that diversification of activities is the most appropriate solution. This is useful for improving tourist service and satisfaction towards the activities experienced by tourists with the elephants; so that the variety choice of tourism activities may reduce the frequency of elephant use as a tourist attraction.

The number of tourists who decided to experience in the four tourism activities mentioned above is still far below the carrying capacity of the elephant. However, it is unfortunate that the data is currently not adequately available in PLG, including information on the number of tourists who selected to do Elephant Riding activities. Promotions that have not been optimised by managers, especially for overseas market segments, may reflect in the number of international tourists visiting TNWK that is relatively small (Table 1). Marcelina et al. (2018) in its study at PLG TNWK mentioned several facilities, such as the arena of elephant attractions,

playgrounds, trash bins, and toilets which were poorly maintained and damaged, and that the numbers were still lacking. Besides that, general tourism facilities and infrastructure in Lampung Province, especially around TNWK area and others are also still inadequate. Hence it influences the satisfaction of tourists, especially international ones.

Tourist satisfaction is one of the essential elements in formulating tourism development strategies (Bagri and Kala 2015, Latiff and Imm 2015). Providing relevant information before tourism activities and the impressions tourists may have when visiting a tourist site for first time may increase their satisfaction, so that they may come again in next opportunity (Park et al. 2018). This satisfaction becomes one of the positive promotions to increase the number of tourist visits, especially to participate in some elephant riding activities at PLG.

If all tourist activities involving the elephants mentioned above are managed to be within the elephant carrying capacity, it may result with the potential to contribute significantly to the increase in non-tax state revenues of IDR 41,600,000 per day (Table 4). This is with the assumptions that the Elephant Riding activities are only in demand by local tourists, while the other four tourist activities, namely: Tracking, Safari, Night Safari, and Full Day, are more favoured by international tourists.

The study by Polyapipat and Loh (2015) on the development of elephant tourism in Thailand reveals that the number of visits decreases every year, as people's comprehension of the preservation and concern for elephants is very high. Tourists make their visit to watch elephant attractions only 1–2 times within one year, and other than that they do activities such

as observing elephant behaviour, seeing them bathing, seeing eating, and photographing. The study conducted by Kopnina (2016) shows how elephant attraction activities in India are no longer allowed to be carried out through torturing these an-

imals. According to Makecha and Ghosal (2017) conservation education programs have turned out to be effective in encouraging people to get closer to non-human species; it will affect the attitude towards conservation of these animals.

Table 4. The income potential of some elephant riding activities per day following the elephant carrying capacity.

No	Type of tourism activities	Elephant carrying capacity/day (person/day)	Income potential		Total (IDR)
			Local tourists (IDR)	International tourists (IDR)	
1	Elephant Riding	300	6,000,000	0	6,000,000
2	Elephant Tracking	50	0	12,500,000	12,500,000
3	Safari	22	0	7,700,000	7,700,000
4	Night Safari	13	0	10,400,000	10,400,000
5	Full Day	5	0	5,000,000	5,000,000
Total					41,600,000

Note: 1 USD = IDR 14,021.50 (5th February 2019).

Conclusions

The number of tourists visiting the PLG TNWK is still within the elephant carrying capacity to support several tourism activities, such as Elephant Riding, Tracking, Safari, Night Safari, and Full Day, which is up to 390 people per day with 23 elephants. Local tourists' preference dominates Elephant Riding, while international tourists favour in the other four activities. Each activity has a different carrying capacity depending on the limited number of elephants and the time duration provided by the manager. The number of elephants involved in carrying out tourism activities that is suitable with their carrying capacity is an endeavour to achieve a balance between protection and tourism goals. PLG managers need to conduct intensive promotions and provide adequate facilities and infrastructure to increase the number of tourists, mainly on special interest tourism activities with relatively higher prices, such as Tracking, Safari, Night Safari, and

Full Day; hence non-tax state revenues may increase significantly up until these activities have reached their carrying capacity.

Acknowledgements

The authors extend their gratitude and appreciation to the Ministry of Research, Technology and Higher Education, the Republic of Indonesia for funding support through the PSNI (Institutional National Strategy Research) Grant Scheme in 2018. They also convey their recognition and appreciation to Lampung University, Way Kambas National Park Agency, and all parties who facilitated the implementation of this research.

References

ARIKUNTO S. 2010. *Prosedur Penelitian: Suatu Pendekatan Praktek* [Research Procedure:

- A Practical Approach]. Rineka Cipta, Jakarta. 198 p. (in Indonesian).
- BAGRI S.C., KALA D. 2015. Tourists' satisfaction at Trijuginarayan: An emerging spiritual and adventure tourist destination in Garhwal Himalaya India. *Turizm* 19(4): 165–182.
- BOULLON R.C. 1985. *Planificación del Espacio Turístico*. Trillas, Mexico City. 245 p. (in Spanish).
- BANSIDDHI P., BROWN J.L., THITARAM C., PUNYAPORNWITHAYA V., SOMGIRD C., EDWARDS K.L., NGANVONGPANIT K. 2018. Changing trends in elephant camp management in northern Thailand and implications for welfare. *PeerJ* 6:e5996 DOI 10.7717/peerj.5996.
- [BTNWK] BALAI BESAR TAMAN NASIONAL WAY KAMBAS 2012. *Sekilas Informasi Taman Nasional Way Kambas – Kabupaten Lampung Timur, Provinsi Lampung* [Brief Overview on Way Kambas National Park – East Lampung Regency, Lampung Province]. Balai Besar Taman Nasional Way Kambas, Labuhan Ratu. 34 p. (in Indonesian).
- [BTNWK] BALAI BESAR TAMAN NASIONAL WAY KAMBAS 2016. *Rencana Pengelolaan Jangka Panjang Taman Nasional Way Kambas Provinsi Lampung Periode 2017–2026* [Long Term Management Plan of Way Kambas National Park Lampung Province for 2017–2026]. Balai Besar Taman Nasional Way Kambas, Labuhan Ratu. 92 p. (in Indonesian).
- [BTNWK] BALAI BESAR TAMAN NASIONAL WAY KAMBAS 2018. *Data Kunjungan Wisatawan di Pusat Latihan Gajah* [Data on Tourist Visit in Elephant Training Centre]. Balai Besar Taman Nasional Way Kambas, Labuhan Ratu. 25 p. (in Indonesian).
- DICK R. 2016. The use of elephants in leisure and its negative effects. *Illuminare* 14(1): 1–9.
- DUFFY R., MOORE L. 2011. Global regulations and local practices: The politics and governance of animal welfare in elephant tourism. *Journal of Sustainable Tourism* 19(4–5): 589–604.
- FEBRYANO I.G., RUSITA R. 2018. Persepsi wisatawan dalam pengembangan wisata pendidikan berbasis konservasi gajah sumatera (*Elephas maximus sumatranus*) [Tourist perception in the development of conservation-based educational tourism on Sumatran elephants (*Elephas maximus sumatranus*)]. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan* 8(3): 376–382 (in Indonesian).
- GRUNEWALD C., SCHLEUNING M., BOHNING-GAESE K. 2016. Biodiversity, scenery and infrastructure: Factors driving wildlife tourism in an African Savannah National Park. *Biological Conservation* 201: 60–68.
- HARMONY G., PITOYO A.J. 2012. Kajian potensi gua sebagai arahan wisata minat khusus penelusuran gua di Pulau Nusakambangan [Study on cave potential as tourist referral for special interest in caves exploration/ caving on Nusakambangan Island]. *Jurnal Bumi Indonesia* 1(3): 20–28 (in Indonesian).
- INDRAWAN M., PRIMACK R.B., SUPRIATNA J. 2007. *Biologi Konservasi* [Conservation Biology]. Yayasan Obor Indonesia, Jakarta. 625 p. (in Indonesian).
- KERLEY G.I., GEACH B.G., VIAL C. 2003. Jumbos or bust: Do tourists' perceptions lead to an under-appreciation of biodiversity? *South African Journal of Wildlife Research* 33(1): 13–21.
- KOPNINA H. 2016. Wild Animals and Justice: The case of the dead elephant in the room. *Journal of International Wildlife Law and Policy* 19(3): 219–235.
- LATIFF K., IMM N.S. 2015. The impact of tourism service quality on satisfaction. *International Journal of Economics and Management* 9(S): 67–94.
- MAKECHA R.N., GHOSAL R. 2017. Elephant conservation: Reviewing the need and potential impact of cognition-based education. *International Journal of Comparative Psychology* 30: 1–7.
- MARCELINA S.D., FEBRYANO I.G., SETIAWAN A., YUWONO S.B. 2018. Persepsi wisatawan terhadap fasilitas wisata di Pusat Latihan Gajah Taman Nasional Way Kambas [Tourist perception of tourism facilities at Elephant Training Centre in Way Kambas National Park]. *Jurnal Belantara* 1(2): 45–53

- (in Indonesian).
- MARSIGLIO S. 2017. On the carrying capacity and the optimal number of visitors in tourism destinations. *Sage Journals* 23(3): 532–646.
- MUTANGA C.N., VENGESAYI S., CHIKUTA O., MUBOKO N., GANDIWA E. 2017. Travel motivation and tourist satisfaction with wildlife tourism experiences in Gonarezhou and Matusadona National Parks, Zimbabwe. *Journal of Outdoor Recreation and Tourism* 20: 1–18.
- PARK S., HAHN S., LEE T., JUN M. 2018. Two factor model of consumer satisfaction: International tourism research. *Tourism Management* 67: 82–88.
- PARIDA Y., BHARDWAJ P., CHOWDHURY J.R. 2017. Effects of economic development and crime on tourism in India. *Anatolia* 29(1): 63–73.
- POLYAPIPAT P., LOH A. 2015. Tourists' Understanding of the Elephant Business in the Tourism Industry: A Study of International Tourists in Chiang Mai Province, Thailand. *Abac Odi Journal Vision Action Outcome* 2(2): 1–22.
- RANAWEERAGE E., RANJEEWA A.D.G., SUGIMOTO K. 2015. Tourism-induced disturbance of wildlife in protected areas: A case study of free ranging elephants in Sri Lanka. *Global Ecology and Conservation* 4: 625–631.
- RATHNAYAKE R.M., GUNAWARDENA U.A.D.P. 2013. Enjoying elephant watching: A study on social carrying capacity of Kawdulla National Park in Sri Lanka. *Sabaragamuwa University Journal* 12(1): 23–39.
- RUGGIERO G., VERDIANI G., SASSO S.D. 2012. Evaluation of carrying capacity and territorial environmental sustainability. *Journal of Agricultural Engineering* 43(2): 65–71.
- [WAP] WORLD ANIMAL PROTECTION 2017. Taken for a ride, The conditions for elephants used in tourism in Asia. Available at: https://www.worldanimalprotection.org.au/sites/default/files/au_files/taken_for_a_ride_report.pdf. (Accessed on 2nd February 2019).
- WAHYUDI H.A. 2016. Catatan HLH: Mengembangkan, ratusan gajah sumatera terbunuh sejak tahun 2012 [HLH Note: Tragis, hundreds of Sumatran elephants killed since 2012]. Available at: <http://www.mongabay.co.id> (Accessed on 1st February 2019) (in Indonesian).