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Collaborative planning for development of the Pelawan Biodiversity Park in Bangka, Indonesia

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Abstract. *Akbarini D, Iskandar J, Partasasmita R. 2017. Collaborative planning for development of the Pelawan Biodiversity Park in Bangka, Indonesia. Biodiversitas 18: 1602-1610.* Pelawan Biodiversity Park is located in the village of Namang, Sub-district of Namang, District of Central Bangka. The Pelawan Biodiversity Park with a size of approximately 47 hectares is intended as a conservation area in Bangka to protect various distinctive plants and animals, especially the plant species *Tristaniopsis merguensis* (Griff.) Peter G.Wilson & J.T.Waterh. A preliminary review of Pelawan Biodiversity Park management planning was undertaken between January and March 2017. The purpose of this preliminary review was to obtain information for planning and managing the Pelawan Biodiversity Park which has an important function for conservation, ecotourism and research in the Central Bangka District. The method used for the study was qualitative with field data collection; namely observation, intensive interviews with informants and analysis of documentation. The results of the study show that the management planning for Pelawan Biodiversity Park has not been implemented collaboratively with stakeholders. Furthermore, the potential for biodiversity in the Palawan Biodiversity Parks has not been properly analyzed and used to develop strategies for conversation, ecotourism and research. The proposed solution to this deficiency in the planning of the Pelawan Biodiversity Park is to invite relevent stakeholders comprising village government, community leaders, universities, researchers, non-governmental organisations and private organizations to actively collaborate in the process.

Keywords: Biodiversity park, collaborative planning, conservation *in-situ*, ecotourism*, Tristaniopsis merguensis*

INTRODUCTION

Indonesia is a tropical archipelago situated between the continents of Asia and Australia, and also located between two oceans, the Pacific and Indian Ocean. As a result, Indonesia has a high diversity of flora and fauna, as well as a highly diverse human culture (Iskandar 2016). Based on recent data from the Indonesian Institute of Sciences (LIPI), flora diversity in Indonesia recorded 1,500 species of algae 1,500 species of algae; 80,000 species of organisms with spores (i.e. Cryptograms) for example fungi; 595 species of moss and 2,197 species of ferns; and 30,000-40,000 species of seed plants (15.5 % of the total number of the world's flora). Meanwhile, in terms of fauna, it is documented that Indonesia has 8,157 vertebrate species (mammals, birds, herpetofauna, and fish) and 1,900 species of butterflies (10% of the world's species) (Widjaja et al. 2014).

Biodiversity has an important role in human life, either directly or indirectly (Koziell 2001, Iskandar 2015). Biodiversity has direct functions for human society in terms of providing subsistence and trade-able goods for village people. Indirect functions of biodiversity consist of ecosystem services such as the production of oxygen and the fixing of carbon by vegetation, and the maintenance of gene pools for constituent organisms. There are currently unused functions of biodiversity such as genetic resources that can allow for development of future options in agriculture. Biodiversity also provides for various other purposes such as the development of ecotourism.

To conserve various species of flora and fauna, the Indonesian government has developed both *ex-situ* species conservation and in-situ species conservation strategies. Facilities for ex-situ species conservation consist of botanical gardens, zoological gardens, safari parks, and gene banks. Facilities for *in-situ* species conservation comprise the nature reserves, wildlife reserves, national parks, national recreational parks, hunting parks, and protection forest areas (Supriana and Sukandar 1996; Wiratno et al. 2004). In addition, with the purpose of conserving various species and their genetic resources in some places of Indonesia, the Government of the Republic of Indonesia through the Minister of Environment issued the Regulation of the Minister of Environment of the Republic of Indonesia Number 03 Year 2012 on development of Biodiversity Parks (*Taman Kehati*) (Anonymous 2012). A Biodiversity Park may be defined as a reserve area of local biological natural resources outside official forest areas, which have *in-situ* and/or *ex-situ* conservation functions, especially for pollination of plants and/or seed dispersal. The Biodiversity Parks achieve this

by maintaining the structure and composition of vegetation that can support resident populations of pollinating animals and seed dispersers.

Currently, there are 72 Biodiversity Parks (*Taman Kehati*) in 22 Provinces of Indonesia. One of the Biodiversity Parks is the Pelawan Biodiversity Park located in Namang Village, Namang Sub-district, Central Bangka District of Bangka Belitung Archipelago Province. The Pelawan Biodiversity Park has many functions. One of them is to conserve the special tree of Pelawan/Pelawan Merah (*Tristaniopsis merguensis* (Griff.) Peter G.Wilson & J.T.Waterh) This species has been recognized as one of the key species for biodiversity sustainability in Central Bangka district, since the Pelawan Tree can guarantee the growth of the fungus Heimioporus sp. and as a feed tree by Apis dorsata (honeybee) because the nectar of the tree is used as the main feed (Akbarini 2016).

The development of Pelawan Biodiversity Park was initiated by the Regional Government of Central Bangka District in 2013. Pelawan was chosen as the location for the Biodiversity Park because this area has various plant species that are beneficial for the livelihood of the community, especially the *Pelawan Merah* Tree (*Tristaniopsis merguensis*). This plant has an important role as host of the fungus (*Heimiporus* sp), and its nectar is food for *Apis dorsata* bees that are known to produce 'bitter honey'. This honey is a popular product of the Bangka Belitung Archipelago Province. Moreover, the bees are important pollinators of various local plant species in the region.

Since Pelawan was first proposed as the location for a Biodiversity Park, so an area was proposed by the Namang Village Government as a protected area in Namang Village. In addition, it was officially established through the Decree of the Central Bangka Regent No.188.45/586/DPK/2009 on the Determination of the *Kalung* Area of Namang Village, Namang Sub-district, Central Bangka District as a Protected Area.

Although biodiversity is known to play an important role for ecological, socioeconomic and cultural functions for human well-being, loss of various species of flora and fauna have occurred both within conservation and non-conservation areas in Indonesia. Indeed, in some instances, conservation areas have not properly guaranteed protection of biodiversity.

Despite the fact that biodiversity conservation has direct socio-cultural consequences for the lives of local people, its role in the management of flora and fauna, including whole ecosystems has often been neglected, even ignored (Cunningham 2001; Newing et al. 2011). As a result, in some cases, local people have not obtained appropriate benefits from such conservation programs (Iskandar et al. 2016; Partasasmita et al. 2016).

This paper reports recent preliminary research to elucidate a model for collaborative planning in the development of the Pelawan Biodiversity Park of Bangka. This model will be improved upon and completed by further, more intensive study in the near future. Aspects discussed in this paper focus particularly on a general view of the Pelawan Biodiversity Park, on history of the area, on its current biodiversity, and on planning for management of the Palawan Biodiversity Park.

MATERIALS AND METHODS

Study area

The study was conducted at Pelawan Biodiversity Park (*Taman Kehati Pelawan*) situated in Kalung Area, Namang Village, Namang Sub-district, Central Bangka District of Bangka Belitung Archipelago Province, Indonesia, located $2^0$19'18" South latitude and $106^0$09'51" East Longitude (Figure 1). Pelawan Biodiversity Park (*Taman Kehati Pelawan*) with a total area of 47 hectares was built by the Government of Central Bangka District. The Pelawan Biodiversity Park is a forest area that lies in Namang Village. The location is about 40 km from the central district. Namang village is an area of 37.76 km^2 (18.47% of Namang District). Geographically, the location of Namang District is considered as interior, not close to the coast. Physically, Namang area is located in the lowlands at an altitude of between 0 and 10 meters above sea level. Topographically, it is considered flat. Namang has an average rainfall of about 1,200 mm per year (Statistics Bureau of Bangka Tengah 2016).

Procedure

The study method used was qualitative (Newing et al. 2011; Creswell 2014). Data collection included field observations, in-depth interviews with several informants, and an analysis of relevent documents. The field observations were undertaken to determine the general conditions of the forest area of Pelawan Biodiversity Park, Intensive interviews were conducted with competent informants. The informants were purposively chosen, namely key representative staffs of the Environment Agency of the Central Bangka District (*Bappelitbangda*), the Forestry Service of the Provincial Government (*Dinas Kehutanan Provinsi*), the Namang Sub-district (*Kecamatan*), the Namang Village, the managers of the Pelawan Biodiversity Park management unit, and several local people.

Data analysis

Data resulting from the documents, field observations and deep-interviews were analyzed by cross-checking, summarizing, synthesizing, and building up a narrative account based on descriptive and evaluative analysis (cf. Newing et al. 2011).

RESULTS AND DISCUSSION

A model of Pelawan Biodiversity Park management was constructed based on the principles of Community-Based Resource Management (MacKinnon 1981; Richardson and Pugh III 1981; RCCO-IPB 1998). Steps in such a procedure include obtaining a general understanding of the Pelawan Biodiversity Park system; problem definition; system conceptualization; model formulation; simulation of the model; policy analysis, and policy

implementation. In this paper, however, only the preliminary steps were carried out: in particular, the development of an understanding of the system, of the Park's potential biodiversity, and of the various obstacles and constraints; followed by elucidation of a planning model for the Pelawan Biodiversity Park.

System of the Pelawan Biodiversity Park

The Pelawan Biodiversity Park ecosystem is composed of several sub-ecosystems: namely flora and fauna (the forest), visitors, local people, managers of the biodiversity park, and government (Figure 2).

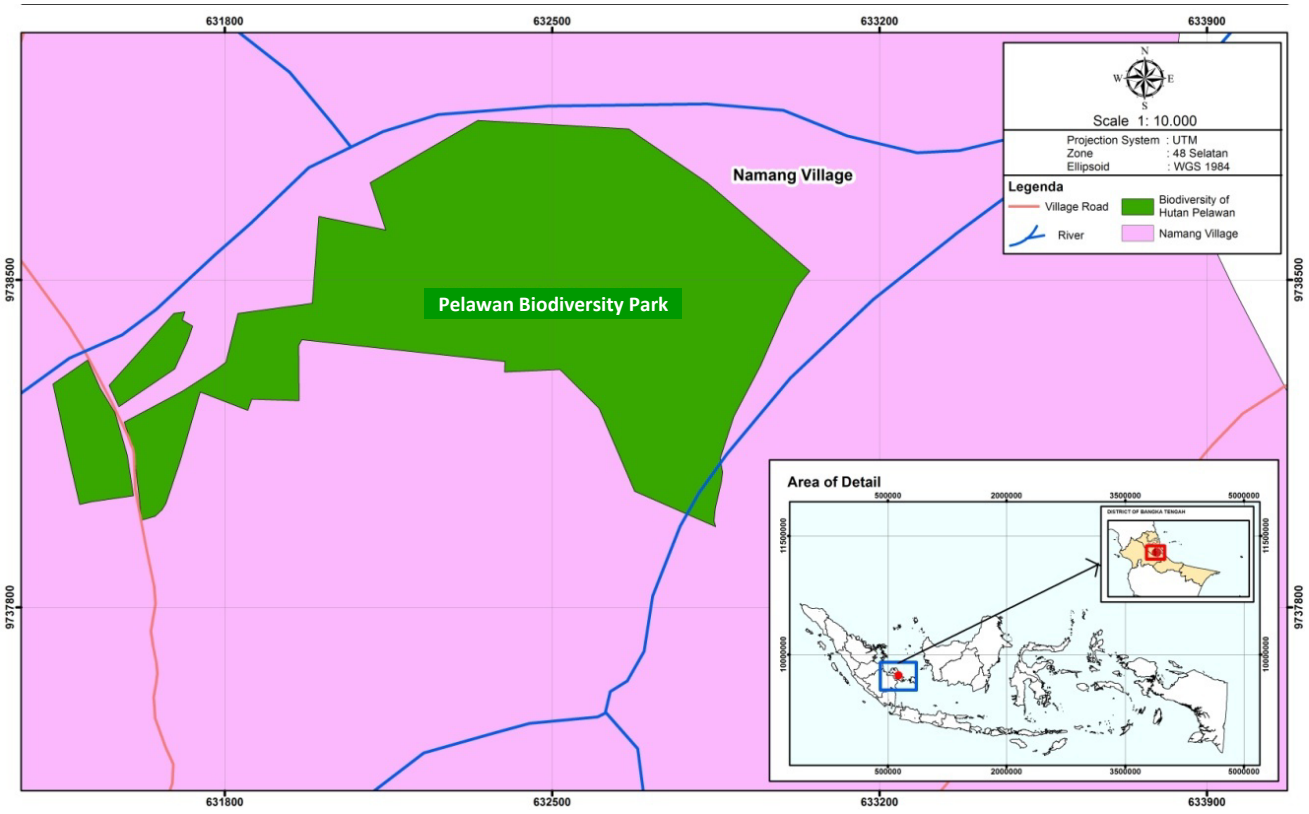

Figure 1. Research location at Pelawan Biodiversity Park in the Kalung Area, Namang Village, Namang Sub-district, Central Bangka District, Bangka Belitung Archipelago Province, Indonesia

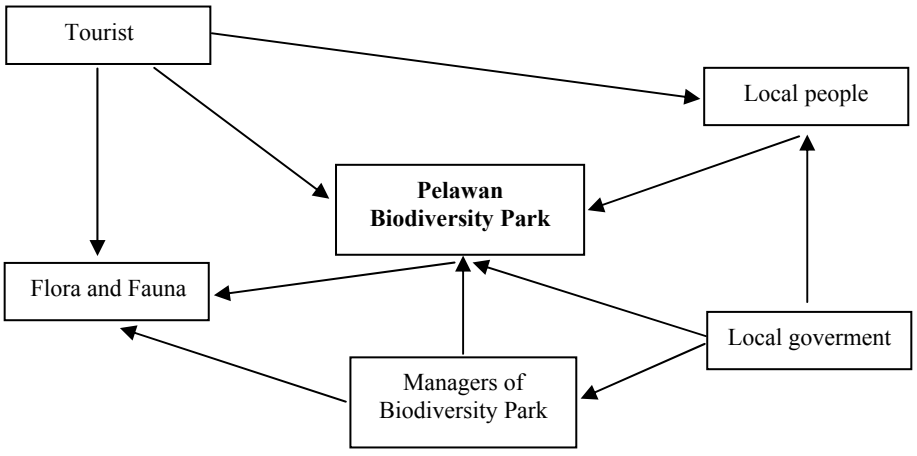

Figure 2. System of the Palawan Biodiversity Park, Central Bangka District, Bangka Belitung Archipelago Province, Indonesia consists of the flora and fauna, local government, local people, and managers

The components that make up the ecosystem of Biodiversity park are interconnected with each other. Therefore, changes in one component may cause changes in other components. The management objectives of Pelawan Biodiversity Park are primarily to protect the flora and fauna, as well as the area, so that the park can be useful in providing ecological services as well as socio-economic and cultural benefits to society. The ecological benefits include conservation of the living species and their genetic diversity; the preservation of the integrity of an oxygen-producing, carbon-fixing forest ecosystem; protection of the soil from erosion; regulation of the hydrological system; and preservation of wildlife habitats. At the same time, socio-economic and cultural benefits to society include among others the strengthening of regional science, education of the community in the values of eco-conservation; and promotion of different kinds of forest products, such as mushrooms and medicinal herbs.

Various kinds of potential disturbances must be taken into account in developing a management model for the Pelawan Biodiversity Park, including the impacts of activities by local people or by visitors.

The history of Pelawan Biodiversity Park

Information gained from intensive interviews with Namang village elders indicates that in the era before Indonesian independence the Kalung area was recognized as a primary forest area. However, over time, with increasing populations in the post-independence era, the Kalung area began to change; forest was cleared and used as places to plant upland rice fields or swidden rice (*hume* or *ladang*) as well as gardens. The activity of swidden rice farming (*hume*) was practiced until about the early 1990s. After that, the Kalung area was considered to be village forest consisting only of secondary forest and shrub land (*blukar*) along with residual planted crops such as rubber and fruit-bearing trees. Moreover, the area became a place for people to obtain various incidental subsistence needs, such as stakes to support pepper plants (*junjung* in the language of Bangka), traditional medicinal plants, timber for building materials, honey from bees, mushrooms and ornamental plants.

After declaration of Decree of the Minister of Trade and Industry no. 146 of 1999, issued in 2001, tin is no longer considered a strategic commodity, so its mining and trade should not be overseen by the central government (Nordholt and Klinken 2007). Therefore, in the area around the Kalung area, which is an informal tin mining site by the people of Namang Village, became more developed in 2004. This area is located not so far from Kalung and is called by local people as the Aik Layang area. In that year, also, many village households used wood from the forest for building materials, either to supply their own needs or else to sell to earn cash income.

Due to the large number of people involved in mining tin at that time, local people, including the village head, became worried that the Kalung area would be expanded to serve the interests of both miners and private companies. Therefore, in 2002 the head of the village decided that the Kalung area had to be preserved. His concern was also shared by the Village Consultative Board (BPD). At that time, the forest area of Kalung was also being encroached upon by illegal cutting. So, in 2008, because of the environmental destruction caused both by tin mining and forest encroachment, the villagers of Namang Village through their village head proposed that the Namang forest be declared a protected area. Agreement for this proposal resulted in the formal setup of a Protected Area in *Kalung Area* under the Namang Village Rule No. 3 Year 2008.

At the same time, on the basis of the Decision of the District Government of Bangka Tengah Number 188.45/586/DPK/2009 on the Determination of *Kalung Area* Namang Village, the area in Namang was declared to be a Protected Area. This determination was in line not only with the dynamics of regional development, but also took into account the potential gain from managing this protected area of *Kalung* to be utilized more optimally for the the welfare of the community. It envisaged that the Kalung forest area would function not only as a site for environmental conservation, but also as an opportunity for the development of ecotourism and regional research particularly for the development of the area's pelawan tree population (*Tristaniopsis merguensis*). As a result, the Government of Central Bangka District determined that this area become a Biodiversity Park (*Taman Kehati*) by the Decree of District of Central Bangka Number 188.45/403/KLH/2013 on the Determination of Kalung Area as the Pelawan Biodiversity Park (Decree Bangka Tengah 2013).

The decision of the Central Bangka Government to nominate the Kalung Protection Area as a Biodiversity Park (*Taman Kehati*) was also supported by the Government of the Republic of Indonesia, through the Minister of Environment, via its Regulation of the Minister of Environment No. 3 of 2012 on Biodiversity Parks (Anonymous 2012), in accordance with the implementation of Law Number 32 Year 2009 on Protection and Environmental Management (Anonymous 2009). It stated that in order to implement development of natural resource reserves, central Government, provincial governments, district/municipal governments or individuals can build Biodiversity Parks outside of formal forest areas, thus allowing for determination of the change in status of the *Kalung Area* from Protected Area to Biodiversity Park (*Taman Kehati*), by implementation of Regulation of Environment Minister No. 3 Year 2012. At the time of the development of the Biodiversity Park in Namang Village, there were no private initiatives in the area, such as by the Aqua Danone Group (Gunawan and Sugiarti 2015; Gunawan et al. 2016); nor initiatives from universities such as Semarang State University (Priyono et al. 2015).

The potential of flora and fauna diversity in Pelawan Biodiversity Park

The area of Pelawan Biodiversity Park has a high diversity of flora and fauna, with the potential to attract the interest of visitors and to stimulate the development of ecotourism in the area (Wistaria et al. 2016). In terms of

the flora, for example, it has been recorded that the precinct contains at least 93 species in the seedling stage, 69 species at the stake stage, 29 species at the pole stage, and 9 species in the tree stage. In addition, this area is known to have a rich fauna. Based on the primary study of the area, there has been recorded 6 species of amphibians, 8 species of reptiles, 13 species of mammals, 33 species of birds and 6 types of insects (Wistaria et al. 2016). As examples of this biodiversity, the birds commonly found in the Pelawan Biodiversity Park are listed in Table 1, while a listing of the common flora in the Park is presented in Table 2.

Among the fauna, there is a species of tarsier that is distinctive of the local fauna in Bangka Belitung Archipelago Province; namely *Cephalopachus bancanus* (local Bangka name: *Mentilin*; Indonesian name: *Krabu Ingkat*). Based on the conservation status listings of IUCN, this is considered to be a vulnerable species.

In addition, a wide variety of bird species have been recorded in the Palawan Biodiversity Park (Table 1). Some of the birds are known as protected species based on National Indonesian Law and international assessment by the IUCN. For example, *Setornis criniger* is considered a vulnerable species on the IUCN Red List. Because this species is restricted to low-lying forests in regions where this habitat type is being cleared and degraded at a catastrophic rate, rapid and continuing population decline is suspected (Birdlife International 2017 b). Other bird species, including *Rollulus rouloul, Lophura ignita, Phaenicophaeus sumatranus* and *Otus rufescens*, are considered as Near Threatened on the IUCN Red List. In addition, though the Oriental Honey-buzzard, *Pernis ptilorhyncus,* is documented as of least concern based on the Birdlife International (2017 a) it is classified as a protected animal by the Indonesian Government, based on the law no 5 of 1999 on protection of Biodiversity and Ecosystems, and Government Regulation no 7/1999 on fauna preservation (Anonymous 1999).

Among the unique and distinctive flora in the area,is the Pelawan tree *Tristaniopsis merguensis*. The presence of the Palawan forest in the Kalung area was considered a basis for the establishment of the Biodiversity Park (*Taman Kehati*) in the Province of Bangka. *Tristaniopsis merguensis* is a recognised habitat for the growth of mushrooms around its roots. The *Pelawan* mushrooms include a *Heimiporus* sp. (a member of the *Boletaceae* family of mushrooms), popularly named by local people as *kulat/jamur pelawan*. These mushrooms grow in symbiosis to form an ectomycorrhizal association with Pelawan trees. The Pelawan mushrooms are recognized as a food source of omega-6 and omega-9 fatty acids. The Pelawan mushrooms contain seven essential amino acids namely valine, methionine, threonine, isoleucine, phenylalanine and lysine. The Pelawan mushrooms are also a source of natural antioxidants with the ability to capture free radicals. The antioxidant components present in the fungus are phenolic components (4.77mg GAE/gbb), β-carotene (15.37 μg/gb) and lycopene (6.34 μg/gb) (Rich 2011).

Table 1. Biodiversity of birds in Pelawan Biodiversity Park, Central Bangka District, Bangka Belitung Archipelago Province, Indonesia

Family	Species	English name	Indonesian name
Accipitridae	*Pernis ptilorhynchus* (Temminck, 1821)	Oriental Honey-buzzard	*Sikep Madu Asia*
Ardeidae	*Gorsachius melanolophus* (Raffles, 1822)	Malayan Night-heron	*Kowak Melayu*
Ardeidae	*Ixobrychus eurhythmus* (Swinhoe ,1873)	Schrenk's Bittern	*Bambangan Coklat*
Caprimulgidae	*Caprimulgus affinis* (Horsfield, 1821)	Savannah Nightjar	*Cabak Kota*
Caprimulgidae	*Lyncornis temminckii* (Gould, 1838)	Malaysian Nightjar	*Taktaran Melayu*
Columbidae	*Chalcophaps indica* (Linnaeus, 1758)	Emerald Dove	*Delimukan Zamrud*
Colimbidae	*Geopelia striata* (Linnaeus, 1766)	Zebra Dove	*Perkutut Jawa*
Columbidae	*Treron vernans* (Linnaeus, 1771)	Pink-necked Green Pigeon	*Punai Gading*
Columbidae	*Spilopelia chinensis* (Scopoli, 1768)	Spotted Dove	*Tekukur biasa*
Cuculidae	*Cacomantis merulinus* (Scopoli, 1786)	Plaintive Cuckoo	*Wiwik Kelabu*
Cuculidae	*Cacomantis sepulclaris* (Müller S., 1843)	Rusty-breasted Cuckoo	*Wiwik Uncuing*
Cuculidae	*Cacomantis sonneratii* (Latham, 1790)	Banded Bay Cuckoo	*Wiwik Lurik*
Cuculidae	*Centropus bengalensis* (Gmelin, 1788)	Lesser Coucal	*Bubut Alang-alang*
Cuculidae	*Chrysococcyx minutillus* (Gould, 1859)	Little Bronze Cuckoo	*Kedasi Laut*
Cuculidae	*Chrysococcyx xanthorhynchus* (Horsfield, 1821)	Violet Cuckoo	*Kedasi Ungu*
Cuculidae	*Rhinortha chlorophaeus* (Raffles, 1822)	Raffles's Malkoha	*Kadalan Selaya*
Cuculidae	*Phaenicophaeus curvirostris* (Shaw, 1810)	Chesnut-breasted Malkoha	*Kadalan Birah*
Cuculidae	*Phaenicophaeus sumatranus* (Raffles, 1822)	Chesnut-bellied Malkoha	*Kadalan Saweh*
Phasianidae	*Cortunix chinensis* (Linnaeus, 1766)	Blue-breasted Quail	*Puyuh batu*
Phasianidae	*Lophura ignita* (Shaw, 1797)	Crested Fireback	*Sempidan Biru*
Phasianidae	*Rollulus rouloul* (Scopoli, 1786)	Crested Partridge	*Puyuh Senggayan*
Rallidae	*Amaurornis phoenicurus* (Pennant, 1769)	White-breasted Waterhen	*Kareo Padi*
Rallidae	*Rallina fasciata* (Raffles, 1822)	Red-legged Crake	*Tikusan Celuring*
Stringidae	*Otus lempiji* (Horsfield, 1821)	Collared Scops-owl	*Celepuk Rebah*
Strigidae	*Otus rufescens* (Horsfield, 1821)	Reddish Scops-owl	*Celepuk Merah*
Turnicidae	*Turnix suscitator* (Gmelin, 1789)	Barred Buttonquail	*Gemak Loreng*

Note: Adapted from the Environmental Agency of Bangka Tengah District (2015)

Table 2. Biodiversity of flora in the Pelawan Biodiversity Park, Central Bangka District, Bangka Belitung Archipelago Province, Indonesia

Family	Species
Anacardiaceae	*Campnosperma auriculatum* (Blume) Hook.f.
Apocynaceae	*Alstonia scholaris* (L.) R.B.
Apocynaceae	*Alstonia angustifolia* Wall. ex A.DC.
Apocynaceae	*Alstonia spatulata* Blume
Aquifoliaceae	*Ilex cymosa* Blume
Aquifoliaceae	*Ilex* sp.
Araliaceae	*Polyscias diversifolia* (Blume) Lowry & G.M.Plunkett)
Arecaceae	*Korthalsia* sp
Arecaceae	*Caryota mitis* Lour.
Arecaceae	*Plectocomia elongata* Mart. ex Blume
Arecaceae	*Chamaedorea elegans* Mart.
Clusiaceae	*Garcinia parvifolia* (Miq.) Miq.
Clusiaceae	*Garcinia riedeliana* Pierre
Clusiaceae	*Calophyllum nodosum* Vesque
Clusiaceae	*Calophyllum pulcherrimum* Wall. ex Choisy
Clusiaceae	*Calophyllum soulattri* Burm.f.
Dilleniaceae	*Dillenia suffruticosa* (Griff.) Martelli
Dipterocarpaceae	*Shorea ovalis* (Korth.) Blume ssp. *ovalis*
Dipterocarpaceae	*Vatica rassak* (Korth.) Blume
Dipterocarpaceae	*Vatica chartacea* P.S. Ashton
Elaeocarpaceae	*Elaeocarpus floribundus* Blume
Euphorbiaceae	*Hevea brasiliensis* (Wild. ex A. Juss.) Müll.Arg
Euphorbiaceae	*Macaranga pruinosa* (Miq.) Müll.Arg
Phyllanthaceae	*Aporosa octandra* var. *malesiana* Schot.
Fagaceae	*Lithocarpus bancanus* (Scheff.) Rehder
Fagaceae	*Castanopsis argentea* (Blume) A.DC.
Hypericaceae	*Cratoxylum arborescen*s (Vahl) Blume
Hypericaceae	*Cratoxylum glaucum* Korth.
Lauraceae	*Dehaasia cuneata* (Blume) Blume
Lauraceae	*Litsea* sp
Lauraceae	*Cryptocarya crassinervia* Miq.
Leguminosae	*Adenanthera microsperma* Teijm. & Binn
Melastomataceae	*Pternandra azurea* (DC.) Burkill
Melastomataceae	*Pternandra caerulescens* Jack
Melastomataceae	*Pternandra rostrata* (Cogn.) M.P.Nayar
Moraceae	*Artocarpus integer* (Thunb.) Merr.
Moraceae	*Artocarpus nitidus* Trecul
Myrtaceae	*Leptospermum polygalifolium* Salisb.
Myrtaceae	*Rhodamnia cinerea* Jack
Myrtaceae	*Syzygium barringtonioides* (Ridl.) Masam.
Myrtaceae	*Syzygium bankense* (Hassk.) Merr. & L.M. Perry
Myrtaceae	*Syzygium decipiens* (Koord. & Valeton) Merr.& L.M. Perry
Myrtaceae	*Syzygium caudatilimbum* (Merr.) Merr. & L.M.Perry
Myrtaceae	*Syzygium kunstleri* (King) Bahadur & R.C.Gaur
Myrtaceae	*Syzygium grande* (Wight)Walp.
Myrtaceae	*Syzygium lineatum* (DC.) Merr. & L.M.Perry
Myrtaceae	*Syzygium muellerii* (Miq.) Miq.
Myrtaceae	*Syzygium pyrifolium* (Blume) DC.
Myrtaceae	*Syzygium rostratum* (Blume) DC.
Myrtaceae	*Syzygium zeylanicum* (L.) DC.
Myrtaceae	*Syzygium* sp
Myrtaceae	*Tristaniopsis merguensis* (Griff.) Peter G. Wilson & J.T.Waterh.
Olacaeae	*Ochanostachys amentacea* Mast.
Oleaceae	*Chionanthus ramiflorus* Roxb.
Pandanaceae	*Pandanus furcatus* Roxb.
Pandanaceae	*Pandanus dubius* Spreng.
Pentaphylaceae	*Adinandra dumosa* Jack.
Rhizoporaceae	*Gynotroches axillaris* Blume
Rubiaceae	*Gaertnera vaginans* (DC.) Merr.
Rubiaceae	*Jackiopsis ornata* (Wall).
Rubiaceae	*Timonius flavescens* (Jacq.) Baker
Rubiaceae	*Urophyllum* sp.
Sapotaceae	*Payena leerii* (Teijsm. & Binn.) Kurz
Sapotaceae	*Palaquium rostratum* (Miq.) Burck
Symplocaceae	*Symplocos adenophylla* Wall. ex G. Don
Symplocaceae	*Symplocos celatrifolia* Griff. ex C.B. Clarke
Theaceae	*Schima wallichii* Choisy
Theaceae	*Gordonia excelsa* (Blume) Blume

Note: Adapted from Wistaria et al. (2016)

The flowers of *Tristaniopsis* are known to be a feed source for honeybees in the area. The honey produced by the bees is commonly harvested by the local people, and the honey is well known as a popular and distinctive product of the province of Bangka Belitung Archipelago. It is popularly known as *madu pahit pelawan*. Unlike the sweet taste of honey in general, this honey produced by the bee *Apis dorsata* has a unique bitter taste, from which the local name 'bitter honey' derives.

Based on interviews with informants, there is local knowledge about the particular trees in *Taman Kehati* that are used as feed by *Apis dorsata* in the production of honey. These include not only the *Pelawan* Tree (*Tristaniopsis merguensis*), but also *Rempudung* Tree (*Elaecarpus* sp.), and *Kabal* Tree (*Lithocarpus bancanus* (Scheff.) Rehder) found predominantly in the area.

Two years ago, in 2015 the local people on Bangka Island began to produce a herbal tea from the leaves of *Tristaniopsis* sp. According to the local people's perceptions, the leaves of the *Tristaniopsis* can be used medicinally. Based on tradition and local knowledge inherited from their ancestors, the boiled leaves of *Tristaniopsis* have been traditionally used to cure high blood pressure and diabetes. Traditional healers (herbalists) in Namang havealso used the leaf of this species on an empirical basis as one of the herbs in the treatment of diseases for childhood illnesses. Laboratory tests, have shown that the dry powdered leaves of *Tristaniopsis* contain 0.03% flavonoid, 0.9% saponin,1.04% tannin, and 6 % protein (Titisari 2016).

Another example of the interesting flora of the Palawan Biodiversity Park is the pitcher plant *Nepenthes ampullaria* Jack. The IUCN Red List categorizes this species as of Least Concern in terms of its conservation status and currently it is listed in Appendix 2 of the CITES database. The species is is a detritivore and is recognized as having an important function in fixing carbon. For example, on Natuna Island, *Nepenthes ampullaria* has been estimated to absorb CO_2 at a rate of 9.96 µmol/$m^{2/}$s (Mansur 2012, pers. com). Based on tradition, local people in Namang village use the water contained in the closed pitchers as a cough medicine and in eye pain medications. Utilization of

Nepenthes as a remedy for eye ailments is also part of the traditional medicine of people in West Sumatra (Rismita 2009).

Disturbances to the Palawan Biodiversity Park

On the basis of field observation and interviews with informants, it is known that there have been disturbances to the conservation functions of Palawan Biodiversity Park, namely by some tourists/visitors. In general visitors are unaware of the need to conserve the environment of the Palawan Biodiversity Park. For example, they commonly exhibit inappropriate behaviors, such as littering, and writing and carving their names on the trees and facilities. Disturbance to the ecosystem of the Park also arises from activities of the local people. For example, some have harvested various non-timber forest products, such as mushrooms and honey, but have not yet participated in efforts to maintain the Biodiversity Park. They have sometimes secretly harvested timber wood at night time. Farmers also intensively use pesticides to control pests in their plantations located close to the Palawan Biodiversity Park area. Consequently, the biodiversity of fauna is probably affected by the toxic effects of these pesticides.

An additional issue concerning the management status of the Palawan Biodiversity Park is that the land is not fully owned by the local government. Consequently, the Palawan Biodiversity Park has not been optimally managed by the Managers of the Biodiversity Park. Another factor recorded as causing disturbance to the Park is the exploitation of various natural resources in the Park due to the increasing economic penetration by the people arising from their increasing economic needs (Suryawan et al. 2015).

As a result of these various deleterious impacts, the sustainability of the Palawan Biodiversity Park will require the development of a well-defined management model.

Management of the Pelawan Biodiversity Park

The formulation of a Biodiversity Park management model requires several activities to be carried out: (i) to completion of a data base of existing natural resources, such as the flora and fauna of the area; (ii) completion of a database of existing socio-economic and cultural conditions; (ii) establishment or improvement of management institutions; (iv) empowerment and organization of community participation; (v) preparation of the Pelawan Biodiversity Park management model; (vi) implementation of the plan; and (vii) monitoring and evaluation (RCOO-IPB 1998). Thus, in order to develop an effective management model, the following data are needed:

Natural resources

Data is required on natural resources including: inventories of flora and fauna; mapped details of the landscape; evaluation of the conservation status of natural resources, such as details of protected flora and fauna according to Indonesian and international (e.g. IUCN) standards; natural resource potential for ecotourism; level of utilization of natural resources by local community.

Economic and cultural aspect

This aspect includes the number and density of the population that exists around the Pelawan Biodiversity Park; the people's livelihoods; identification of the types of flora and fauna that the population uses; details of the frequency and forms of subsistence and commercial use of the area's resources; details of the people's product marketing system of natural resources; institutional and social organization of the community.

Empowerment and community organization

There is a need to identify existing community institutions, both formal and informal institutions. Participation by the community needs to be accommodated in order to strengthen the bargaining position of the community in making decisions about management of the Pelawan Biodiversity Park. If such community institutions do not already exist, then it will be necessary to encourage their grass-root development.

Modelling

A range of co-management planning procedures need to be implemented, such as (1) raising public awareness of the importance of natural resources of the Palawan Biodiversity Park to support the community; (2) improving the ability of the community to participate at every stage of the integrated management, and (3) increasing the income of the community by sustainable and environmentally sound utilization of resources.

Implementation of the plan

Implementation of the model management plan requires that activities involve the community, through education and training, and involving the community in detemining policy direction, in enforcement and in regulation.

Monitoring and evaluation

Monitoring involves assessing the effectiveness of the management process, as well as identifying deviations and conflicts in the implementation of the plan. Monitoring and evaluation is carried out in order to identify the weaknesses and advantages of the management system as implemented, and in order to improve the system in the future.

It is known that biodiversity provides direct economic benefits to communities in terms of food, medicine and industrial raw materials. It also supplies the ingredients for natural ecosystems to provide an array of essential environmental services (photosynthesis, absorption and breakdown of pollutants, and much more). Furthermore, like human beings, plants and animals, have inherent rights to existence. We have an ethical reponsibility to value and conserve their diversity (Smitinand 1997).

Because the Palawan Biodiversity Park of Central Bangka District has important ecological and socioeconomic functions for the local community, excellent management is essential to ensure the sustainability of the Park. Moreover, local people have a legitimate right to be allowed to participate in decision-making concerning the use of the local natural resources (Haugen 2011). Their forests need to be maintained

because public good arise from such forest resources (Adalina et al 2014). It is feared that if management does not take into account the conservation status of the area then the purposes in establishing the the Park will not be fulfilled.

Based on our preliminary field observations, some disruption and threats to the existence of the park have been documented. For example, visitors have caused littering, and have damaged trees with graffiti. Some visitors have also freely entered into areas of the Park and damaged some facilities due to lack of care by the visitors and lack of supervision by the Park managers. Defiencies in management are due in part to inadequete managerial resources. Moreover, the management system for the Palawan Biodiversity Park has not been established in accordance with standard operational procedures of the government. Management planning in the the Park has not yet been implemented along the lines of an integrated collaborative model. Engaging the community in collaborative planning must be integral to the management program in order to harmonize and optimize conservation of the environment with the economic development interests of the local community (Dahuri et al. 2013). Collaborative planning is an effective planning model that is more likely than other planning models to benefit the public interest (Gunton and Day 2003). To achieve this, it will be necessary to clarify the roles of the various participants in the collaborative process (Carr et al. 1998).

Based on the results of this study, it is concluded that management of Palawan Biodiversity Park should involve all relevant stakeholders in collaborative planning, implementation and monitoring of progress. These stakeholders, consisting of village government, community leaders, universities and researchers, non-governmental organisations and private organizations, should be invited to participate in planning the management system for the Park. Management of the Park should incorporate the conservation of existing flora and fauna in its precincts as a basic principle in the planning process, so that sustainability of the Park's natural ecosytem can be guaranteed for the future. In such a way the Park can achieve the goal of *in situ* conservation of the Kalung area for the benefit of the Namang Village community and the wider society, which would fulfil the original vision that inspired the establishment of the park.

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