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To cite this article: Irina Safitri Zen *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **298** 012021

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# Take Stock Bali Island as the Potential of Biosphere Reserve Site

**Irina Safitri Zen<sup>1</sup>, Yohanes Purwanto<sup>2</sup>, Prima Wahyu Titisari<sup>3</sup>, Yani Hendrayani<sup>4</sup>, Syed Ahmad Iskandar Bin Syed Ariffin<sup>5</sup>**

<sup>1</sup>Department of Urban and Regional Planning (URP), Kulliyah of Architecture and Environmental Design, International Islamic University Malaysia (IIUM), 50728 Kuala Lumpur, Malaysia.

<sup>2</sup>Indonesian MAB Programme National Committee, Science and Knowledge Institution of Indonesia (LIPI)

<sup>3</sup>Department of Biology, Faculty of Education, Universitas Islam Riau, Pekanbaru, Riau, Indonesia.

<sup>4</sup>Faculty of Social and Political Science (FISIP), Universitas Pembangunan Nasional, Veteran, Jakarta, Indonesia

<sup>5</sup>Architecture, Faculty of Built Environment & Surveying, Institute Sultan Iskandar, Universiti Teknologi Malaysia, Johor, Malaysia

irinazen@iium.edu.my, irinasafitri@gmail.com.

**Abstract.** Adopting biosphere reserves, BRs in the area with local protected area and international designated area will embrace the community involvement to support its biosphere stewardship function. It is argued that the community with a strong social capital as well as strong traditional ecological knowledge and culture will contribute to strengthen the conservation efforts by providing more opportunity at the local level through the specific zonation of the UNESCO Man And Biosphere, MAB program. By using the Bali Island as a case study, the study analyses to what extent the potential of Bali island as a Biosphere Reserves, BRs site by take stock the natural resources, governance of the conservation park as well as the human cultural and social capital aspect. The latest has been recognised as crucial element to develop social enterprise and entrepreneurs as stated in the Lima Action plan to deliver Sustainable Development Goals, SDGs 2030 in BRs site. Hence, the paper found out the three sites in Bali island, the two are the important international designated sites; the Bali island cultural landscape as a manifestation of Tri Hita Karana in Subak system by United Nations Educational, Scientific and Cultural Organization, UNESCO World Heritage Site and the West Bali National Park protected area category II by the International Union for Conservation Nature, IUCN and the last is the national park of Monkey Forest in Ubud as the initial assessment of take stock Bali BRs. Nevertheless, the study found the manifestation of Balinese philosophy, Tri Hita Karana or ‘Three Sources of Wellbeing’ which represents the existence pluralistic collectivism actions at the local level has potential to accommodate the adaptive governance crucial to manage the commons in biosphere reserve. Finally, the paper came up with the conceptual model of proposed Bali BRs that accommodate the natural capital as well as the social capital in zonation concept of BRs. However, further detail study on the ecosystem services functions and sustainable livelihood need to be conducted to support the nomination of Bali Island as the future biosphere reserve.



## 1. Introduction

Take stock in general is making an overall assessment of a particular situation, typically before making a decision. In this context, it is a precondition assessment prior to submission of certain international designated sites aiming to enhance the conservation activities in the area with a special endemic biodiversity and unique physical characteristic. Take stock is mostly used for forest conservation in a protected area as to update the status of biodiversity capacity such as take stock fish and non-fish for a better planning area as to provide better recreational fishing opportunities [1], and the effects of forest institutions by developing forest take stocking index [2]. For more inclusive approach, take stock includes a broader spectrum of actors and rights holders, covers landscapes and seascapes protected by indigenous peoples, local communities, private owners and other actors which complement conservation areas managed by state agencies [3]. This type of take stock activities emphasized in the Guidelines for Protected Areas produced by ICUN [4] which covers the take stock of recent development, trends, and progress in related with to the environmental law. The coverage includes the intersection of biological diversity conservation, climate change mitigation and adaptation at the core of livelihood preservation. Hence, this study adopts the broad range of inclusive take stock with the aim to assess the potential of Bali island to adopt the biosphere reserve concept. At first, what are the type of existing protected area as well as the challenges and issues will be evaluated. Second, assessment will be done according to the zonation concept of biosphere reserves under the United Nations Educational Scientific and Cultural Organization, [5] Man And Biosphere (MAB) Program.

Other Our study inline with the recent Lima Action plan, where biosphere reserves site was acknowledged as a demo site to achieve sustainable development goals, SDGs 2030. In this case, it is argued that having additional BRs designated site will enhance the inclusivity of the communities, the villagers, the local stakeholders, local government and academia involving in any kind of activities related with BRs. By having the buffer zone which dedicated for living lab for training, educational and eco-tourism site, it will enhance the stewardship function to the core zone which adopt the protected area concept.

Geographically, Bali island lies in the west of the Wallace Line which is rich in the fauna combination of Asian character and a little Australasian influence. There are around 280 species of birds, including the critically endangered Bali Myna, which is endemic and an exception of the yellow-crested cockatoo, a member of a primarily Australasian family. Hence, the protection of these living things are needed to sustain their existence for the future generation as well as the Bali ecosystem as a whole. Considering the 21 percent of the total Bali island or 5,780 km<sup>2</sup> has been recognized as the National forest reserves area, Bali island received international designated area under the IUCN Protected area category II. Furthermore, the rich cultural landscape of Balinese for the manifestation of philosophy Tri Hita Karana has been acknowledged as the UNESCO world heritage site, WHS, in 2012. Having these two international designated sites for both conservation purposes, man and nature will be enhanced by the inclusive approach of three zonation of biosphere reserves with strong stewardship function from the community.

Protected area by definition is needed to balance the existing development and preserve some unique characteristics. In different countries there are many types of protected areas established with different objectives and designated names such as national park, nature reserve, national reserve, etc. The system of categorization which has been developed by the IUCN for protected areas, is based on their management objectives. For Categories I and II, the area are strictly protected against any consumption of human activities, but for Categories III and IV, certain types of interventions such as sustainable use of natural resources are allowed. About two-thirds of the world's protected areas have now been assigned an IUCN management category, while 33.4% remain uncategorized [6]. In this case, West Bali National Park is categorized under IUCN protected area category II.

We were argued that, the exclusivism of protected areas whose primary goal is to conserve biological diversity and provide ecosystem services disregards the local people involvement. In fact, it ignored their relationship with nature which has been developed since long time ago [7]. The establishment and management of protected areas which tend to inhibit the local people from

depending on natural resources then causes poverty, mainly in developing countries. Hence, the issues have developed into ethical issues or specifically human-rights issues because the local indigenous people human rights are not considered in the national and global conservation strategies. In other words, 'protected areas should not exist as islands, divorced from the social, cultural and economic context in which they are located' (Recommendation 5.29, Vth IUCN World Parks Congress). Hence, the UNESCO biosphere reserves, BRs zonation concept, offers alternative for the community to be involved sustainably through the ecotourism activity as well as improvement of the sustainable livelihood condition.

The Man And Biosphere, MAB Programme of UNESCO aims for BRs to become "training grounds" to develop sustainable development principles translated into local contexts [8,9]. The three main functions of a BR are: conservation including preservation of ecosystems, landscape, species and genetic resources; logistic support covering support projects, research and monitoring, environmental education; and development comprising foster sustainable economic and human development. The adoption of the three zonations are expected to strengthen the earlier effort of protected area which did not allow the community involvement [10,11,8]. Thus, the BRs zonation offers more viable community development vis-à-vis conservation of the natural resources in a mutual benefit or win-win situation.

Furthermore, the adoptability of biosphere reserves suits with the National Park system in early 1980s to reinforce the protected area system which was originated from the earlier Dutch system. It was issued under the Regulation Number 18 on Nature Tourism Enterprising in Utilisation Zone of the National Parks, Botanical Garden, and Recreation Parks in 1994 or known as Regulation 18/1994 [12]. The regulation allows private tourism companies to operate in the utilisation zones of National Parks with the main aim is "to increase the use of natural beauty and uniqueness of the National Park's utilisation zone, botanical garden and recreation parks" (article 2, point 2), and requires "private tourism enterprise to involve the people living in the surrounding areas in its business activity" (article 10, point e). The main objective of local involvement is to empower communities economically so they are less dependent on forest or marine resources for their livelihood [13]. Methodology

We are argued that area with international designated sites whose focus on conservation has more potential for biosphere reserves nomination. The research analyzed the existing protected area in Bali island which has the local recognition and the international designated sites for the possible adoption of the zonation concept of biosphere reserves developed by UNESCO Seville Strategy in 1996 [14]. Core zone is defined as a legally protected area with no human activity permitted. It acts as reference points on the natural state of the ecosystems. Buffer zone includes activities such as protective area around the core zone, human activity is restricted to the management of ecosystem resources, conserving natural processes and biodiversity. This zone may also accommodate education, training, tourism, and recreation facilities. Human use is less intensive than that in the transition zone. Transition zone is defined as area of cooperation, where people lives and work. Human activity is the one which makes use of nature; resources sustainably for economic and social activities.

Reassigning the area according to BRs zonation creates positive effects especially in developing the collective resource-management programs, particularly in the buffer zone. The program builds trust, develops new norms, and improves natural capital outcomes between the local people and the natural resources which become increasingly common described as community, participatory, joint, and decentralized management, and co-management [15]. BRs zonation functions as a living lab for the academic research and hands on training ground for the action research involving the community and stakeholder at the local level. Furthermore, robust and immediate result output produced by those activities provides continuous improvement for the community implementing the tools as to support the BRs status. Hence, in March 2016, the 4th World Congress of BRs held in Lima, Peru, announced a new vision for the Man And Biosphere (MAB) UNESCO Program for the decade 2016-2025. It was launched by mainstreaming the UNESCO BRs as "Models for national/regional demonstration of sustainable development" within national and global agendas for the 2030 Sustainable Development Goals, SDGs.

Furthermore, the paper takes stock the existing three sites for the potential of Bali island being part of biosphere reserves. The details function of each zone are explained in Figure 1. There are three sites, the two have received international designated areas and third site which has national park status is proposed to be either the core zone or buffer zone of BRs zonation for Bali. As mentioned before, we adopt the take stock approach in an inclusive form where broader spectrum of actors and stakeholder in the context of conservation efforts [3]. This also include take stock activities developed by ICUN which include recent development, trends, and progress in related with the environmental law and governance in conserving the site [4]. These two approaches will adopt interchangeably in our analysis for potential site of Bali BRs. We are aware that this simple yet first attempt to come up with Bali BRs may not enough to support the submission. Details study which cover the land use analysis, sustainable livelihood and ecosystem service is needed. At the end, we will come up with the conceptual design of Bali BRs by considering the unique species recognized in UNESCO WHS cultural landscape, IUCN category II for west Bali national park and Ubud Monkey forest.



**Figure 1.** The Biosphere Reserves of the Three Zones Schematic Diagram [5]

## 2. Result and Discussion

The study found out that there are three sites of protected area in the Bali island which have been regulated under the local and national jurisdiction as well as acknowledged as the international designated sites. The three are i. West Bali National Park recognised by the IUCN Protected Area Category II, ii. Bali island cultural landscape, the UNESCO World Heritage Site, and iii. Monkey forest nature park in Ubud. It is argued that having another international designated site such as UNESCO MAB which is specially designed to involve community with a support from various stakeholder will enhance the performance of conservation with active participation from the local communities in various form activities.

By having biosphere reserve, the sites will have more biosphere stewardship function. The biosphere stewardship function is about the management of ecosystem services, social, economic and cultural contexts in which this management operates and how issues like justice, power and politics shape the operation of social ecological systems, SES and the institutional and governance challenges [16]. This concept is relevance for MAB and WHS programme where respecting people's preferences, wishes and values and combatting injustice are fundamental ethical issues and challenging in the context human well-being and social resilience. Having this concept of the stewardship of landscapes and seascape allows continuous learning and knowledge generation across knowledge and systems dynamics through the social-ecological systems and ecosystems services and their dynamics. Hence, it requires skills and competences from applying and utilising existing experiences embedded in, e.g., local and traditional knowledge systems and institutions, to the experimenting, innovating, and development of new approaches for stewardship like adaptive and transformative governance;

### 2.1. *The West Bali National Park, the IUCN Protected Area Category II.*

The West Bali National Park is a nature conservation area with a pure ecosystem managed by the zone system to serve multipurpose of uses involving education, tourism and recreation activities. The tourist activity in this area is also endorsed by Indonesian Government Regulation Number 18/1994 on Nature Tourism Enterprising in Utilisation Zones of National Parks, Botanical Gardens, and Recreation Parks, on Park administration and local communities, and the implications of these impacts for management of Parks as commons [17].

The existence of Bali Myna or the Bali Starling (*Leucopsar rothschildi*) with a local name Jalak Bali [18] as the only Bali's native animal is the main reason of protecting this national park and became the flagship species of the Park [19]. This emblem bird of Bali is on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species, which is currently listed as Critically Endangered, and is now the second rarest bird in the world.

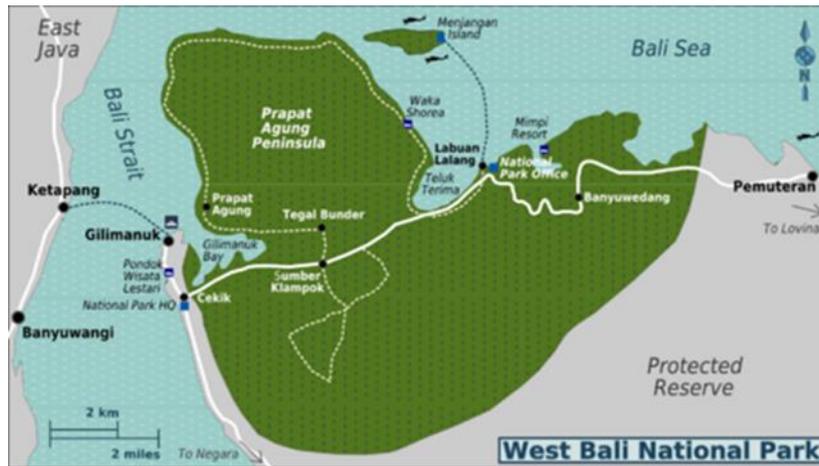
Based on the Forestry Minister decision letter No. 493/KPTS-II/1995, Bali west national park owns 19.002,89 hectares area which consists of 15.587,89 hectares of land and 3.415 hectares of sea [20]. The land covers almost 5% of Bali's entire land area which consists of rainforest in monsoon and coastal forest, dense mangrove forest, dry savannah and sea grass; in addition, it is also unique as it includes 1,000 meters of coral reef, sandy beaches and islets. The area composes of mountains and extinct volcanoes with Mount Patas in a 1,412 metres and the Mount Merbuk in 1,388 metres, which represent as the highest point. There are three entrances for the West Bali National Park. First, through the entrance by entering the park along the north coast road from the Lovina which takes about 90 minutes. The second route is through Pemuteran about 15 minutes and lastly from the south via Gilimanuk which takes about 15 minutes (Figure 3). Several famous tourism spots in this area cover jungle tracking and diving. There are Serijong Temple built with the intention to honour Dang Hyang Dwijendra who is profoundly good teachers in Bali island and could provide illumination. God Baruna as the manifestation of Almighty God is worshiped in this temple.

Numerous species exist in this area including 176 species of flora, 17 types of mammals, and 160 bird species (Aves) in addition to reptile species and fish. Mammals found in the park include Banteng, a wild cattle (*Bos javanicus* sp.). It is a species of wild cattle found in Southeast Asia which derives the familiar Bali cows. There are around 1.5 million domestic banteng(s) which are called Bali cattle that are used as working animals and for their meat [21]. Java Rusa or Indian Muntjac deer with scientific name *Rusa timorensis* sp. is also commonly found in this area. Menjangan island is in fact named after this animal Menjangan or deer in Bahasa Indonesia. Wild boars and leopard cats are both quite common, but rarely found. Wild boar or *Sus scrofa* sp., also known as the wild swine is a type of Eurasian wild pig or simply wild pig that find as a native from Eurasia, North Africa, and the Greater Sunda island, while leopard cats or *Prionailurus bengalensis* are found on numerous small offshore islands of mainland Asia. This species is under the IUCN red list of threatened species [22].

One of the efforts to conserve the the Jalak Bali or the Bali is by involving the local community to be part of the conservation programme. The Friends of the National Parks Foundation (FNPF) established the Bali Bird Sanctuary in Nusa Penida island group which consists of Penida island, Lembongan island and Ceningan island. The PNPF started the bird conservation initiatives to save Bali Starling in 2006. It began with regional government of Klungkung Regency that started the project with fewer than 10 surviving birds and involving about 46 villages. The project enforced the traditional laws that govern the daily life of the Bali starling and other native birds which need to be protected from poachers and wildlife traders (Friends of the National Park Foundation 2018) [23]. The villages within Bali Bird Sanctuary display signs declaring involvement in the conservation project and developed eco-cultural tourism for the benefits of local communities. Today, the Bali Bird Sanctuary, is a home for over 100 Bali starlings and is announced as an officially protected zone under judicial law.

The nature capital of the native species coupled with the socio-cultural capital of the conservation effort is also being part of the ritual of temple ceremony for the Balinese. For example, Bali starlings are traditionally released to the wild at temple ceremonies while holy water collected from each

temple around the island is sprinkled to bless each Bali starling. This ceremony reflects the spirituality of the community relating to the birds as to ensure the responsibility for social and moral protection under the traditional or customary law. On the release day, a priest conducts ceremonial prayer and blessings before the birds fly to freedom at local temples. For conservation purpose, the nest boxes are placed high in temple trees to ensure the birds are provided with added security in the temple grounds. The conservation effort to maximise ecosystem services of this area focuses on ecosystem protection to support the life, pickling the variety of flora and fauna including the habitat. These data provide a physical capital for the propose Bali BRs.



**Figure 2.** The Map and Trails of West Bali National Park

This park which allows the tourist to witness animals that live nearby is famous with the two trails namely 'Tegal Blunder Trail', which is the most popular place for bird watching activities and the strenuous 'Gunung Klatakan Trail' (Figure 2). The first one is famous for the ornithologists which take an easy two-hour walk in a jungle track and the second trail is the tougher walking that takes about five hours walk. The trails can be done with an official guide from one of the National Park offices. Besides, Teluk Brumbun is well-known for its savannah and landscape, a panorama of Menjangan island can be seen from the ridgepole of the hill.

This area is the best of Bali based diving due to its clear water and calms sea. Dive to uninhabited 'Menjangan island' is a must-see for any visitor to Bali who is interested in marine life, snorkelling or diving. A remarkable temple 'Puri Gili Kencana' can be found in Menjangan island and walk around the entire island takes about 1 hour and 15 minutes on foot. The potential ecotourism in this area is South Bali especially the two magnificent twin lakes, Tamblingan and Buyon that promote snorkelling activity in an area called Pemuteran. This area has been promoted as an ideal place for ecotourism package. However, the conflict between the local communities with the Park management due to the the change of land status, from common property to state property, which limits community access to the Park's natural resources, and failure to exert effective management has been identified in this area [24].

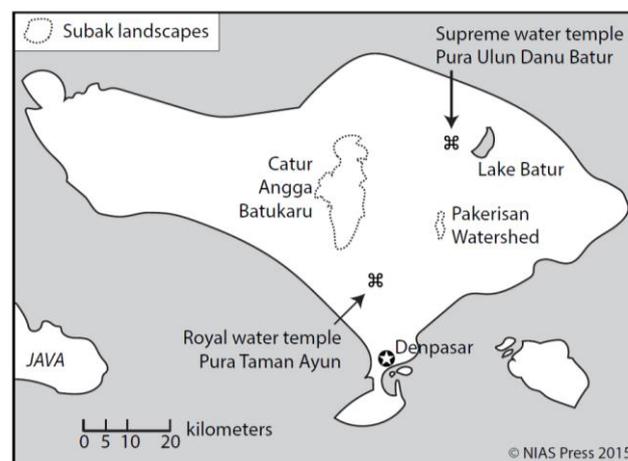
## 2.2. The Bali Island UNESCO Cultural Landscape World Heritage Site

The Balinese cultural landscape of UNESCO, world heritage site, WHS have 1,454,80 hectares of five buffer zones of the total 19,519,90 hectares of land. It has seven components have been identified to be protected, they are; i. the pekaseh or head of farmer, ii. the forest to protect water resources, iii. the rice terraces landscape, iv. the water canal (irrigation system and dam), v. the villages (customary pakraman), vi. the water temple (protected under cultural heritage property's law) and vii. tradition and intangible heritage. The inscription combined the nature and man-made environment shows the

dynamic interaction between man and its environment for a many centuries. Therefore, its outstanding universal values, OUV that need to be protected for the future generation has been recognised.

The philosophy of Tri Hata Karana stated “that has long been the driving principle for Balinese to organically create the picturesque landscape of the rice terraces with their various Subak-temples and environmentally friendly irrigation works.” This philosophy is manifested in the lives of the Balinese through the institutions of Subaks (ancient, democratic self-governing farmer’s associations) and water temples, which give spiritual meaning to the governance of the rice terrace ecology (Figure 3).

The details of Bali province cultural landscape are; i. Supreme water temple of Pura Ulun Danu Batur – Lake Batur, the crater lake, is regarded as the ultimate origin of every spring and river, its congregation appropriately includes all subaks, ii. Subak landscape of the Pakerisan Watershed, is a site encompasses the oldest known irrigation system in Bali (12th century). It includes the lands and watercourses of three subaks and four water temples, iii. Subak landscape of Catur Angga Batukaru, encompasses two lakes (Buyan and Tamblingan) and the forest of Bali’s second highest volcano, Mount Batukaru (2,276 m), which is considered to be the sources of water for the many upland springs that feed Tabanan’s ‘water mountains’, or irrigated terraces, iv. The Royal Water Temple of Pura Taman Ayun (19th century), is the largest and most architecturally distinguished regional water temple in Bali. Water temple is managed by priest and customary villages. There are 16 subak rituals and festivals managed together by head or farmers or Pekaseh. Several Subak rituals are performed either at farmer / individual levels or at Subak level such as picking-up water ceremony and Subak-temple anniversary ceremony and connecting with source of water level (lake, weir) (Figure 3).



**Figure 3.** World Heritage Properties of the Balinese Cultural Landscape.

Source : NIAS Press 2015.

Subak temple is a unique institution as an inspiration of ritual tradition which has been done since the past centuries in Bali. Various rituals are performed at subak temple as the implementation of the philosophy of Tri Hita Karana. Subak gains income in order to support the ritual expenses, farmer and the system itself from the contribution from subak members, punishment payment, duck owners that release ducks after harvesting, and a grant from government. However, Subak also confronts several problems such as opposing the development effort such as land tax system, land conversion, water competition, pollution, and limitation, climate change, low agricultural income, limited land holding and others.

The biodiversity flora and fauna under world heritage site includes Balinese edelweiss or Padang Kasna with the scientific name of *Anaphalis javanica* sp as the endemic species of flower found in kaldera Batur. It is also found in Mount Agung and mountainous area in Java island [25]. Padang kasna is chosen in many ritual ceremony due to its long lasting effect. Edelweiss flower known as the symbol of forever love, purity, sincerity and eternity. It is used widely for canang in Hindu rituals,

Galungan Celebration. Kintamani dog or Cintami, Cicing Kintamani is the dog species famous in Indonesia which is originated from Mount Kintamani, Bali. The dog becomes famous because of the characteristics such as the long-hairy tail. Besides, there are Nyalian beratan and Kuyuh Batur which are the endemic species of fish lives in Beratan lake.

Kokokan bird is among famous bird in Bali found in paddy field area. The bird is recognised from his long leg and white feathers, stand in the paddy field to eat the small fish and other insects in paddy field found. Consist of several species such as kuntul kerbau or *Bubulcus ibis* sp., Kuntul Perak or *Egretta intermedia* sp., Kuntul Kecil or *Egretta garzetta* sp. and Blekok Sawah or *Ardeola spesiosa* sp. [25]. Other type of bird species found in paddy field is from genus *Granivora* or known as the peanut's eater. Those species of bird help to balance the insect population that harms the paddy. Among the famous granivora bird is Gelatik Jawa or in Bali, Gelatik Subeng, *Padda pryzivora* sp. The beautiful bird, with red leg and beak, grey feather, nice gesture and lively moisture attract the bird lover. From bird pest, Gelatik becomes ornamental birds and becomes subject of trading and poaches across the country. ICUN classifies this species will extinct in the next 20 years or 10 percent within 100 years if there is no conservation action taken to save the species [26]. In-situ and ex-situ conservation effort are conducted to safe this species.

Balinese farmer applies the Nangluk Merana and Kerta Massa concept to balance the insecticide population and paddy disease. The concept controls the insect's population without damaging the paddy and the ecosystem and known as local or traditional knowledge of Balinese people that needs to be sustained and adjusted in the current context of modern agriculture. Other applied local knowledge for agricultural is *kungkungan* or the house provided for bird breeding where the birds can live in their community without put in the cage. The type of bird used for *kungkungan* is Petingan Bird, *Lonchura punctulate* sp.

Mount Batukaru and mount Batur consist of tropical rain forest ecosystem dominated by trees with wide leaves such as Mangga (*Mangifera indica* sp.) and cempaka (*Michelia champaca* sp.). Around Batukaru and Kintamani mountain there are plants with two seasons or autumn leaves and carnivora forest. This type of season is found in temperate country. The famous tree in this forest is jati (*Tectona grandis* sp.). Moreover, cemara pandak (*Podocarpus indicartus*), the type of trees with leaf shape needles commonly found in mount Batukaru and Kintamani. These areas are protected as the source of water for Pakerisan watershed that chanellise the water into the river and the Subak system.

Batukaru nature preserves area consists of various species of flora and fauna such as bunut (*Ficus indica*), sompane (*Laplacae* sp.), seeming (*Engerhardia spicata*), cemara geseng (*Casuarina junghuniana*), udu (*Litsea velutina*), belantih (*Homalanthus giganteus*), lateng (*Laportea* sp.) and keduduk (*Astronia spectabilis*). Among the extinct species of trees are cemara pandak (*Podocarpus indricatus*) and kepelan (*Manglitia glouca*). The protected fauna in Batukaru nature preserves are kijang (*Muntiacus muntjac*), babi hutan or wild pig (*Sus vitatus*), wild cat (*Felis bengalensis*), rase (*Vivericula malacensis*), trenggiling (*Manis javanica*), landak (*Hystrix branchura*), budeng/lutung (*Trachypitecus auratus*), grey monkey (*Macaca fascicularis*), landak (*Lariscus insignis*), civet (*Paradoxurus hermaproditus*), wild chicken (*Gallus varius*), peacock bird (*Rhipidura javanica*), owl (*Pypte alba javanica*), srigunting (*Dicrurus renifer*), kalong (*Pteropus edulis*) and eagle (*Haliaestur indus*) [25].

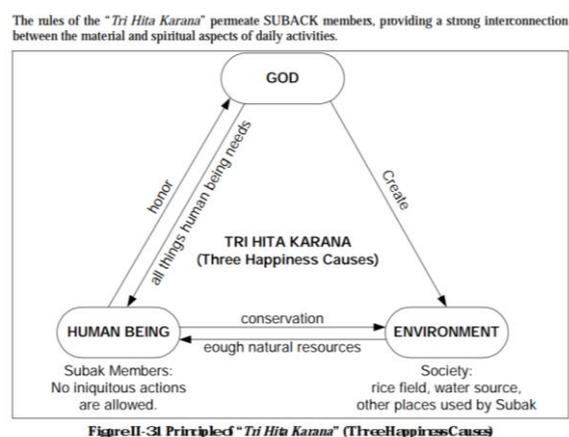
The complexities of Bali island's WHS depends on the Subak as key traditional irrigation associations which is organised and based on its philosophy as way of living in harmony with the supernatural, natural and human worlds. The actual work of this philosophy which produces and maintained in a form of cultural landscapes comprising rice terraces, mountains, lakes, rivers, forests, farming communities and water temples. The selected areas demonstrate an ideal of sustainable development which UNESCO has been promoting in many of its WHSs [27].

The Subak landscape of Catur Angga Batukaru area encompasses the forests of Bali's second highest volcano, Mount Batukaru as well as Lake Tamblingan in Buleleng Regency, which is considered to be the source of water for the many upland springs that feed Tabanan's "water mountains", or irrigated terraces. The 11th century Pura Luhur Batukaru temple, in the forests above

the rice terraces, sits at the apex of Batukaru's temple system. This area contains terraces and temples mentioned in a 10th century inscription, making them amongst the oldest in Bali. This region is regarded as the Utama Mandala or the highest mandala, or sacred landscape in western Bali. Its boundaries and sacred topography are defined by five guardian temples, whose shrines, rites and attributes attach symbolic and spiritual meaning to landscape features. The Batukaru site is a pilot area for the implementation of livelihood and ecosystem conservation initiatives proposed in the management plan.

The Subak landscape of the Pakerisan watershed is the oldest known water irrigation system which consists of three subaks and four temples, Tirtha Empul, Candi Yeh Mangening, Candi Tebing Gunung Kawi, Campuhan, Tampak Siring, Candi Tebing Kerobokan, Candi Pengukur-ukuran and Candi Tebing Tegal Linggah. The watershed was originated from the Kintamani hills and covers 298,800 hectares area with the length of 345,000 km with 162 rivers [28]. One of the rivers, Pakerisan river has the water pollution index class II in the upstream, classified as good condition, whereas in the middle is classified as heavily polluted (Class 5) until the downstream was lightly polluted. The water quality index in Ayung River and Pakerisan River downgraded from Class II, suitable for water-sports to Class III suitable for agriculture. Improper sanitation and sewage treatment are among the factors polluting the river.

Beside the natural resources, the Balinese strong cultural values have been manifested as the social capital for further enhancement of the stewardship function of the proposed biosphere reserves site. The manifestation of Balinese philosophy, represents the existence of pluralistic collectivism actions at the local level. Subak practice in rice terraces paddy field is identified as a local knowledge which has strong social norms and values for sustainable livelihood and community development in buffer cone of BRs. The norm in Subak social capital which is based on the Tri Hita Karana (The Equilibrium of Welfare) has three guiding principles; i. Parahyangan, which is to create a harmonious relationship between humanity and God; ii. Pawongan, creating harmonious relationships between a person and his neighbour; and iii. Palemahan, which is to maintain harmony between humanity and the natural resources (environment) (Figure 4). Balinese people understood the importance of harmony and balance, such that their reshaping the environment contributed to the ecosystem, rather than ruining it. Tri Hita Karana translates to "Three things that create happiness, and well-being."



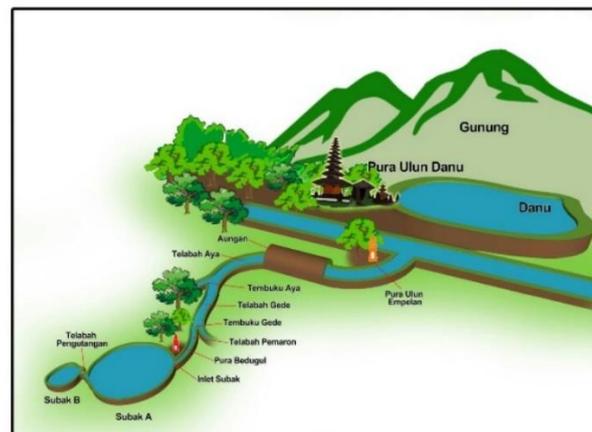
**Figure 4.** Tri Hita Karana 'Three Sources of Wellbeing' of Balinese People  
Source : NIAS Press 2015.

Parahyangan is the most important aspect. It acts as the cultural glue that holds all together. Subak members believe that rice is considered a gift from god. The appreciation for rice plays an important role in the water temples, called Pura Bedugul, where religious ceremonies are conducted. These

ceremonies pay tribute to Dewi Sri, the goddess of fertility and prosperity. Pawongan is the equality and fairness. It is the concept of harmony between people. Furthermore, it exemplifies the democratic structure of a Subak. The function of the entire system is reliant on each member being of equal status, and having equal voice as any other members. A single greedy individual could throw an entire association out of balance. These ancient cultural traditions have been passed from generation to generation, it is unheard of anyone trying to manipulate the system for personal gain. The rules and enforcement of rules are also made by collective decision. All the planning, decisions, distribution, problem-solving, deciding what kind of rice to plant, when to plant, when to harvest, the development of fish or duck to maintain proper ecological balance, and more, are discussed and decided as a group.

Lastly is *Palemahan*, which focuses on environmental balance and sustainability. Subak will set up and maintain their systems to be in harmony. The key is thinking of nature as an equitable partner, rather than a resource to be exploited. Water need, availability, and ways to optimise consumption are prioritised in planning. Other things done are preventing unwanted drainage of water away from the rice patties, and capturing and reusing as much water as possible; people are assigned to monitor waste issues that need to be addressed, ensure water remains clean, and that crop-killing pests are driven away from the farmland, to prevent waste of crops that have already used water. While certain pests are driven out, sometimes other wildlife—such as fish and duck—are introduced to help maintain a vibrant ecosystem.

From the water irrigation and management, Subak is a complex organisational of a network of inter-related paddy field that is also linked the other Subaks in the same water catchment area (Figure 5). About 100-300 Subaks exist in one catchment area, and all form a complex, inter-related, flexible network that in reality integrates the socio-cultural, spiritual, economic, vocational, village and family life of Balinese society [28]. Members of Subak which are called as *Krama Subak*, consist of three membership subcategories. There are the *Krama Aktif* who are actively participating members of the Subak, *Krama Pasif* provide financial support the function of the Subak of active membership, *Krama Luput* members who are not active and have other important duties that take up too much time (such as being a village chief).



**Figure 5.** Conceptual Image of Balinese Cultural Landscape WHS [29]

Subak Social Capital is based on the trust, networking and norm where the member are; i. may be the owner of the rice field or the representative, ii. persons in the board elected democratically in a Subak meeting, iii. member of the board of a Subak consist(ing) of the *Pekaseh* (as the head of the Subak) and then assisted by some *Kelian* (as the head of the sub-Subak) and some direction for sub-Subak (person for doing communication to the members related to the activity should be done), iv. make rules (called *awig-awig*) usually locally for the Subak, v. democratic process of *Pekaseh* election based on trust and vi. have high kind of trust among members called *Bonding Trust*.

This connection is a key for social capital where they have strong connections among the Subak and within the Subak members. The connections build trust for them to share the water irrigate to their paddy field based on democratisation of water governance. Until the 1970s, the predominant industry in Bali was agriculture, driven by the staple food crop of rice [28]. Then tourism took over from agriculture as the dominant economic driving force, but in the Bali of post activities. The Balinese Subaks are the systems of physical and human networks linking the irrigated rice paddy networks. Balinese rice terrace irrigation systems are regarded as unique.

The Balinese ancient landscape heritage called Subak, function as the traditional farming system include(s) complex dimensions of cultural ecology, scientific exploration, political dialogue, community stewardship and the study of nature [29-31]. For the potential of buffer zone of BRs where the scientific research cum community development implement, the Subak present(s) a valuable of place-based approach for deploying sustainable science that is embedded in a social context [32]. The Subak (is) also place(d) as a living lab model in developing sustainable education where the theoretical and conceptual model tested in real-world settings where the cultures, actors and activities are intertwined [32,33]. For that purpose, the Subak can be utilised as an outdoor setting for student engage(d) with the local community, to re-learn the Subak and for researchers to test the new method of community development in the current context of development, i.e. massive tourism that threaten the ancient Subak and the traditional agricultural method with their local knowledge.

Subak also known as organisational water democratic system which connects Subak group to the other group head by *Pekaseh*, head of farmer. Their activity(activities) in distribute(distributing) and managing the water for their paddy field, create social bonding in manifest(ing) the Tri Hitta Karan philosophy which drives their social norms in the society. This capture(s) in the term of social capital where their existence is crucial for sustainability especially of the Balinese cultural landscape. High social capital in formalised groups encourages people to have confidence to invest in collective activities when knowing that others will do so too. Most of the social capital has been established since the early 1990s for watershed, forest, irrigation, pest, wildlife, fishery, and microfinance management [34]. These offer a route to sustainable management and governance of common resources. Moreover, there are four features of social capital that are important to support activities in buffer zone BRs. The four are: relations of trust; reciprocity and exchanges; common rules, norms, and sanctions; and connectedness in networks and groups [35].

### 2.3. The Ubud Monkey Forest

The Monkey Forest is located in the village of Ubud, the district of Gianyar about 20 kilometres north of Denpasar, the provincial capital of the island of Bali. The Monkey Forest has about four hectares area and contains three temples and a graveyard. The three temples are the Pura Dalem or Death Temple, a Cremation Temple and a Bathing Temple. The irrigated rice fields surrounding the Monkey Forest was replaced by shops and hotels being built along northern and southern borders. Other than around 700 monkeys, you also can see 186 species of trees in 12.5 hectares of forest.

For Asian Hindu society, as well as Bali, monkeys are vital components. The monkey god known as Hanuman was originated from the ancient Indian epic poems, the Mahabharata and the Ramayana, that entered Java around the fourth century A.D. has had a strong influence on Indonesia for over a thousand years [36]. Over 93% of Balinese population is Hindu, although Indonesia population consists of over 90% Moslem [37]. The social values of these epics have permeated every aspect of life throughout Indonesia, especially in Bali Hinduism. Hanuman and various other monkeys can be seen in the many dances in Ubud, such as the Kecak, the Ramayana, and the Calonarang. A more fundamental Balinese Hinduism belief relating to conservation is the principle of harmony and balance, tri hita karana, which involves the three forces of people, the universe, and God is essential for health and prosperity of the people [38].

Hence, thousands of years of the ancient mutual association of monkeys and humans for conservation is the manifestation of Tri Hita Karana philosophy where the Monkey Forest Managerial Committee proposed management conservation plan to correct the various imbalances at the Monkey

Forest, such as erosion, loss of flora and fauna, and the overpopulation of monkeys, and to respond to the economy potential of increasing tourism [39]. Jobs are being created to raise the standard of living in the area surrounding The Monkey Forest. The income generated from tourists is going to the desa adat or religious/customary unit of Padangtegal to improve and conserve the temple, therefore, a tribute to God.

In 1991, the conservation plan for Monkey Forest was proposed by the committee established by the Padangtegal's cultural village. The plan covers; i. to change the feeding areas for monkeys in order to avoid the deterioration of the forest and to provide water for the monkeys, ii. stop erosion by building terraces and planting 5 000 seedlings, preferably endangered species that could also be used for ceremonial purposes, iii. to save the jungle fowl and iguana, iv. proposed to hire workers to dean the area, to provide trash cans, and to put up signs telling tourists not to disturb the animals, v. to add a hectare of land to i increase the size of the forest, vi. proper recording of the number of visitors and the income generated each day, vi. better security by adding number of guard posts, vii. Provide maps, toilets, and lights, viii. Increased more parking lots and not allow unauthorized vehicles to enter the forest.

Moreover, the study concluded that Monkey Forest in Ubud which has been recognised as the national forest reserve has potential to be part of the proposed of Bali BRs. There are 749 monkeys and 186 species of trees in 12,500 hectares of the deep forest coexisting with three sacred temples can be proposed as buffer zone of proposed Bali BRs. Moreover, further details sustainable livelihood and inventory as well as the sustainable ecotourism is needed to support the dossier of proposed Bali BRs. Hence, early effort to engage stakeholder and the community is crucial to make sure the buy in from the community surrounding.

### 3. Conclusion

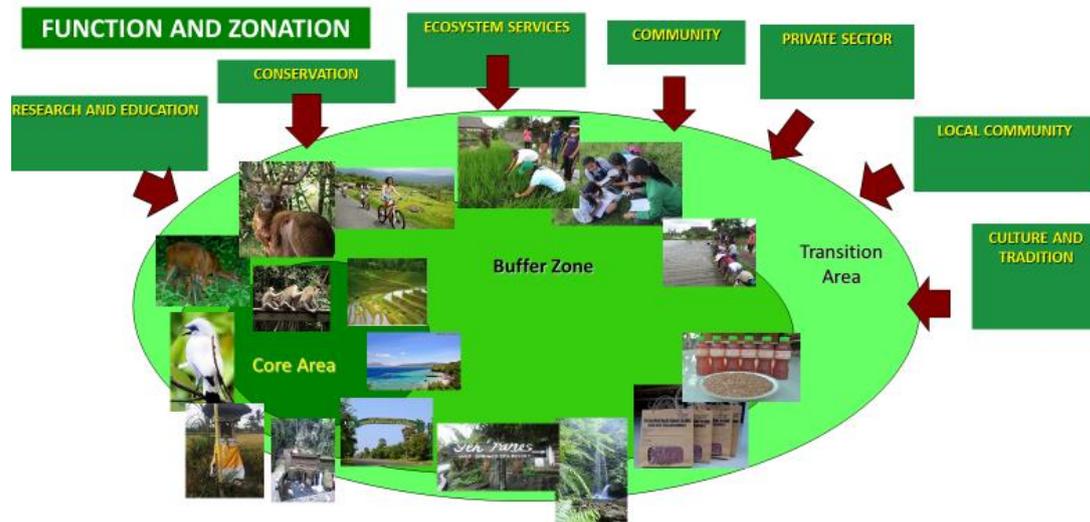
The nature conservation area of West Bali national park that serve multipurpose of uses involving education, tourism and recreation activities endorsed by Indonesian Government Regulation Number 18/1994. The existence of Bali Myna or the Bali Starling (*Leucopsar rothschildi*) is the main reason of protecting this national park and became the flagship species of the Park is acknowledged under the IUCN. The richness of Bali west national park owns 19.002,89 hectares area covers almost 5% of Bali's entire land area. The seascape of west bali national park includes 1,000 meters of coral reef, sandy beaches and islets. Those facts describe briefly the potential of west Bali national park to support the proposed Bali BRs.

The potential Bali cultural landscape of WHS as a supporter for biosphere reserves found in the traditional method of farming system which include complex dimensions of cultural ecology, scientific exploration, political dialogue, community stewardship. This is the potential of buffer zone of BRs where the scientific research cum community development implement, the Subak presents a valuable of place-based approach for deploying sustainable science. Furthermore, the Subak also placed as a living lab model in developing sustainable education where the theoretical and conceptual model tested in real-world settings where the cultures, actors and activities are intertwined. Furthermore, the uniqueness of flora fauna and physical environment has been identified as core zone under UNESCO WHS.

The potential of Monkey Forest in Ubud as to support the Bali BRs has been protected under the national forest reserve. The 749 monkeys and 186 species of trees in 12,500 hectares of the deep forest are coexisting with three sacred temples. The religious performance shows function as a unique stewardship function for demo site of social aspect of the buffer zone of proposed Bali BRs.

From the description of the three areas above, this paper presents the conceptual design for Bali Biosphere Reserves (Figure 6). As the UNESCO MAB programme mission is to balance the seemingly conflicting goals of environmental conservation and socio economic development as well as to maintain the noble values of nations's culture, the Bali BRs need to accommodate not only the physical, natural capital which include their rich biodiversity but also need to consider the social capital that already practices as the social norms and values as well as their traditional ecological

knowledge in Subak system. This integrated capital will strengthen the Bali BRs in apply the Lima Action Plan in deliver and implement SDGs.



**Figure 6.** The Proposed Conceptual Model of the Proposed Bali BRs

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### Acknowledgments

First author would like to thank Universiti Teknologi Malaysia, Ministry of Education financial for partially financial support (Vot No. 18H14). First author has been presented in the 30th UNESCO MAB (Man and Biosphere) Council Meeting, Palembang, Indonesia, the 2018 International Conference on Biosphere Reserve: Engaging Stakeholders Towards Community Empowerment, July 23rd, Palembang, South Sumatera, Indonesia.