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Ecotourism and Climates changes: the ecolodge contribution in global warming mitigation

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ABSTRACT

Global attention to the global warming reduction has invite numerous strategy implemented with the objectives is mitigating greenhouse gasses emission which threats to the future of living in biosphere. Essentially, absorbing CO_2 from atmosphere and sequestering in terrestrial ecosystem is one of the significant strategy. While in developing countries it is become essential, support for forest conservation, afforestation and effort to increase terrestrial ability to capture and storage carbon is poor. Ecotourism offer potential key to solved such problems by promoting ecolodge as a sustainable tourism accomodations. This paper aims to explore the potential of ecotourism sector to alleviate global warming and establishing framework for ecolodge planning and development in tropical developing countries. This paper highlight the significant of ecolodge attraction and development management to meet proper carbon capture and sequestration mechanism. The attraction management and developing programs ultimately able to increase plants biomass while accommodation able to practicing energy efficient and optimizing reuse and recycle approach. It will become the potential solution for reducing greenhouse gas emissions and create clean development strategy.

Keywords: *eco-accommodation, CO_2 reduction, biodiversity conservation, tropics*

INTRODUCTION

Recently, the issue of global warming has been emerged as a significant issue in the world. It has been reported that impact of global warming numerous and potentially contribute to water scarcity, food crisis, biodiversity extinction, and threats the future human living in the biosphere. To respond the global warming crisis, several mitigation strategies has been introduced, encompasses applying green and clean industry mechanism, combating illegal logging and de-forestation, enhancing afforestation and impro-ving forest management practices [1, 2].

There is consensus that developing a sustainable uses of forest resources is essential. A scenario to enhance economic growth without extracted woody trees and disturb forest widely explored. Environmentally friendly industry and economic business should be able to implement clean and green mechanism, and importantly should be able to increase afforestation and conserve green environments [3]. In particular, it is important to seek an industry which contribute to minimize carbon emission and increase system ability to absorb and storage carbon as an integral approach in global warming reduction. Among the few scenarios and mechanisms towards the fascinating industry which are able to reduce and sequester greenhouse gasses, tourism is one of the potential sector to meets such objectives.

The role of tourism to generate national and regional earning, providing jobs, and numerous economical benefits widely discussed. Using tourism to support wildlife and biodiversity conservation has been discussed by several authors [4]. So far, few discussions focus to the role of tourism contribution to mitigate global

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warming. This implies tourism sectors not recognized as a key strategy in global warming reduction mechanism. Developing tourism to generate national and regional earning while in the same time contribute to global warming reduction mitigation could be a new perspectives [4, 5]. Tourism is bringing numerous business sector insides it's practices. There are transportation, entertain, accommodation and other related sectors which shall be meet sustainable principles. Among them, initiatives to promotes tourism contribution towards global warming mitigation has been developed (i.e.. Agenda 21 for the Travel & Tourism Industry) with the objectives to built mutual interrelationship between tourism and climate changes [6]. While many discussion was focus to the minimize carbon release to atmosphere from tourism activities, few was discuss about the contribution of tourism activity to absorb and store carbon.

The general objective of this paper is to explore the potential contribution of ecotourism on global warming mitigation. The paper first intends to provide general review to construct a relationship of ecotourism and the idea behind Carbon Capture and Sequestration (CCS). This is shown by an analysis of the factors generated ecotourism success and its contribution in CCS mechanism. Secondly is to analyze tourism accommodation contribution in the global warming reduction. Third, this paper discuss how the local agendas for eco-accommodation planning and developments should be integrated into tourism planning.

2. Ecotourism and Carbon Capture and Sequestration (CCS)

Ecotourism is a responsible travel to the natural environment. According to scholar, ecotourism is one of the environmentally sustainable business form and ultimately addressed to improve local economic growth while in the same time contribute to conserve biodiversity, encourage local people welfare, protect local culture and tradition. Since its economical benefits arising from such business, many scholar and governments argues ecotourism is the fascinating tools to combat poverty in tropical developing countries and trigger development. Krüger (2005) [4] argues that ecotourism is one of the fundamental strategy to support conservation program. The conceptual model and scenarios to show the role of ecotourism to meet such objective widely explored and tested in several countries. While ecotourism offers potential tools to mitigate global warming, few practical cases have been described and discussed.

Ecotourism is generated by two factor namely demand and supply. Demand ultimately comes from western and industrialized countries [7]. According to Gunn and Var (2002) [6], supply means resources, service, program and attractions in host country or tourism destination. In the recent situation where tourist demands to visit nature-based destination increase [7], providing continues and competitive supply which meets typical ecotourist's demand is essential. Compared to the other tourism, demand-supply system in ecotourism closely relates and builds exclusive relationship due to ecotourist desire to encounter destination with specific criteria such as destination should be nature-based, has rich natural attraction, and offer education program [6, 8]. It is relevant with the recent tourist charac-ter where they have essential characteristics such as paid a lot of attention to nature and aware to local people [7].

Managing supply side, the ecotourism destination in host countries, in the proper ways can enhance the potential of ecotourism to alleviate CO_2. As mentioned above that ecotourism destination has specific criteria, developers and planner strives to provide fascinating destination by establishing new park and garden, creating green environments, maintain environments and apply green business operational. In many cases, it was followed by improving destination's environment through re-planting many endangered and rare trees species. According to scholars, it is commonly found as an effort to increase destination competitiveness to gain potential market. The positive relationship of tourism and increasing forest coverage percentage has been reported by in China by Li et al (2006) [9]. In similar case, our study in Kepulauan Seribu found that native vegetations was conserve and re-establishment of green area were implemented in order to enhance tourism destination in small island [10].

Creating new park and garden, conserving trees and replanting trees mean maintaining and increasing vegetation stand to capture and storage carbon as biomass. The vegetation in

destination, through photosynthesis, could offset carbon dioxide emissions by absorbing CO_2. Forest ecosystem as an ecotourism destination which able to store large amounts of carbon in the trees and soil. Such ecosystem able to remove and accumulate CO_2 from the atmosphere and through photosynthesis process stores the carbon in living trees and other plants. Therefore, it is relevant with the carbon capture storage (CCS) mechanism to combat a global warming by capturing CO_2 and storing it into biomass. CCS refers to a set of approach which was designed to reduce CO_2 emission and therefore mitigate global warming. Essentially, this approach involves capturing CO_2 and then storing the carbon in numerous available reservoir systems in biosphere [11-13].

The tropical parks and garden often characterized by diverse and abundance plants species. According to scholars, different species absorb carbon at different rates and in different environmental conditions. This character offer advantages for maximum carbon absorption. A study by Reich et al., (2001) [11] concludes carbon acquisition and biomass yield are higher in area with high biodiversity compared to area which occupied by less species. Through their research in Eastern Panama, Kirby and Potvin (2007) [14] shows that the highest ecosystem which able to store carbon is managed (an average: 335 t C ha^{-1}), followed by traditional agrofoterest (an average: 145 t C ha^{-1}), and pasture (an average: 46 t C ha^{-1}) respectively. A study by Tiepolo, Calmon and Ferretti as cited in [15] shows that submontane forest able to storage carbon in average 135.9 t C ha^{-1}; 106.8 t C ha^{-1} for the lowland forest. The above ground carbon for pasture recorded 2.4 t C ha^{-1} and the shrubbery 7.4 t C ha^{-1}. These data indicates that ecosystem which was diverse able to store carbon more highest than low diversity ecosystem.

One of the significant natural sequestration processes of removing CO_2 from atmosphere is enhancing its uptake in soil and vegetation. Scholars point out that there are several strategies for storing carbon, namely storing in the ocean, underground geological formation, and in terrestrial ecosystem. Among these strategies, the terrestrial storage strategy has potential success to implement in local scale due to it's less in cost and technology. In such strategy, carbon sequestration is able to implement due to photosynthetic process by green plant. It is the biological process where plant species where CO_2 was captured and converted into organic carbon [13].

Baral and Guha (2004) [16] point out that carbon sequestration by trees is the function of land use and management, time for growing and technological process. Land uses policy and management practices for along time have been known contribute to the green piece availability in the earth. For instance, many countries has developed their own role to allocate specific percentage in their countries size as green area and therefore it is ensuring land capacity to storage carbon in trees biomass and soil. In Indonesia, for instance, governmental law through Law No.26, 2007 (UU no 26 tahun 2007) clearly stated that at last 20% of area should be dedicated to green area. Woody trees and perennial plants species has ability to store carbon in biomass for along time than other categories.

3. Tourism eco-accommodation: The eco-lodge

Accommodation is the basic tourism facilities which its development has received a lot of attention among planners and developers. In order to meet ecotourist need to accommodation, several character of accommodation should be meets, such as located at peace environment, lies on remotes/ wilderness areas, have opportunities to observe nature and wildlife, able to experience native and local culture, support community benefits, provides opportunities to observe plants and animals, and provide physical challenges. The concern about environmentally sound accommodation in tourism led development of the ecolodge [17]. Ayala (1996) [18] argues that ecotourism and environmentally sound accommodation has the inevitable partnership, and therefore accommodation become important. Ecolodge is the typical accommodation which has several character such minimizing environmental impact on natural and cultural, applying sustainable design construction as well as landscaping and gardening, using green technologies, involve local people in ecolodge development and implementation, and integrate environmental and cultural education for visitors [7, 19].

The market of ecolodge recently is growing significantly throughout the world. Interestingly, there correlation between ecolodge distribution in the globe and global biodiversity hot spot areas. TIES notes that ecolodge particularly distributes at tropical regions in Africa, Asia and America. There are Huaorani Ecolodge (Equador), Cristalino Jungle Lodge (Brasilia), Kwanari Ecolodge (Dominica), El Remanso Lodge (Costa Rica), and Udzungwa (Tanzania) ecolodges which receive significant guest yearly [17]. The rapid development of ecolodge in world has inspiring Indonesian to develop ecolodge as a one of the tourism facility with multy objectives. Ecolodge was addressed to increase local community welfare, promote education, and support local environmental conservations. There are Rosa's ecolodge (Situbondo, Baluran East Java), Bukit Lawang ecolodge (Sumatra), Rimba orang-utan ecolodge (Tanjung Harapan Sumatera), Kelimutu crater lake ecolodge (Eastern Flores), and Samboja Orangutan ecolodge (East Kalimantan) which are promotes numerous conservation programs in their operational [20]. Recently, [17] notes that the largest number of ecolodge located at Indonesia, followed by Costa Rica, Thailand, Peru, Ecuador, Guatemala, Mexico, Srilanka and Tanzania. The data of TIES suggest that ecolodge development to facilitate tourist in the field become the interesting business on Indonesia. The development, however, should be addressed to meet sustainable principles.

Ecological principles becomes the fundamentals aspect in ecolodge planning, establishing and monitoring [18, 19]. Many ecolodge, recycling organic matter and promoting environmentally energy supply are the interesting practices contribute to CCS. The recycling organic matters were done by converting farm and agricultural residues. For instance is composting process to convert manure become compost material to provide developed gardening system inside lodge system. Applying organic fertilizers derived from composting process is able to increase the amount of carbon stored in soils and contribute significantly to the reduction of greenhouse gas emissions. Increasing organic matter in soils contribute to greenhouse gas-saving effects, increasing workability of soils, enhance water retention, and reduced release of poisonous pollutant such as nitrous oxide.

Ecolodge pay attention to the effort to conserve highest diversity level of their neighboring environments [19, 21]. Perhaps the most effort associated with this concern is that the rich and native vegetation structure and composition should be maintain. Tall and huge tree with canopy, lianas, bromeliads, aroids, fern, and other plants which is become he characteristics is tropical forest was maintained in ecolodge environment. These benefits may encompasses the increased of CO_2 absorption. The ecolodge wich is set up with vegetation structure and composition similar to primary forest able to storage carbon about 230.10 - 264.70 ton C ha^{-1} (in lowland primary forest) and 193.36 ton C ha^{-1} (in highland primary forest). When ecolodge set up at villages with agroforestry as an environmental setting, it is possible to contribute carbon storage about 80.78 to 192.33 ton C ha^{-1} [22]. Roshetko et al., (2002) [12] note that tropical homegardens in Lampung able to storage carbon about 30 to 123 Mg C ha^{-1}. These lead to the potential strategy to increase carbon capture and sequestration in plant biomass.

In the context of tourism attraction, tropical forest or agroforestry system in rural area is the interesting objects. There are numerous living creatures inside such ecosystem to be potential nature-based attractions [23]. In the recent high competition among tourism accommodations, many ecolodge responds development and market competitions in a variety way. Most of them argues that bringing living naturally experience become the key to sustain and increase their business. That way many destinations nowadays focus to the effort to protect natural environments and restoring degraded environment to provides green environment for the ecolodge business competitiveness.

Gardens is principals component of ecolodge. Gardens is developed ultimately to provides the attractions for increasing guest satisfaction during they stay in ecolodge . In many ecolodge, gardens have been designed for visitors to experiencing native environments. The literature indicates that guest often enjoy some natural objects surrounding their lodge. These may be observing flower, fruits, bees, and birds [21]. The existence of numerous plants in particular places has correlation with high insect and birds diversity. Many woody trees species have dozens

and hundred years old, provides significant key to store Carbon as plant biomass. Recently, garden not only becomes the tourism object, but many of the has been recognized contribute to healing. This is become the additional value of garden in tourism attractions systems [21, 24].

4. The framework future ecolodge development

Future ecolodge development in line with its contribution in global warming reduction can be summarized in Figure 1. Focus particularly should be pay to attraction and accommodations due such aspect significantly able to contribute in carbon capture and sequestration mechanism.

The first principally related to attraction management and developing programs to increase plants biomass. Physically, several actions can be implemented, such as creating new park and improving conservation works of an area where ecolodge was set up. These will allow vegetation cover increase which will followed by increase of carbon absorption through photo-synthesis. Importantly, creating new park and restoring degraded area in ecolodge sites should be similar with its native environment. The introduction on exotic and invasive plan species should be omitted due to such species has been identified harmful to native ecosystem. The second part is related to strengthening accomodation that should be mana-

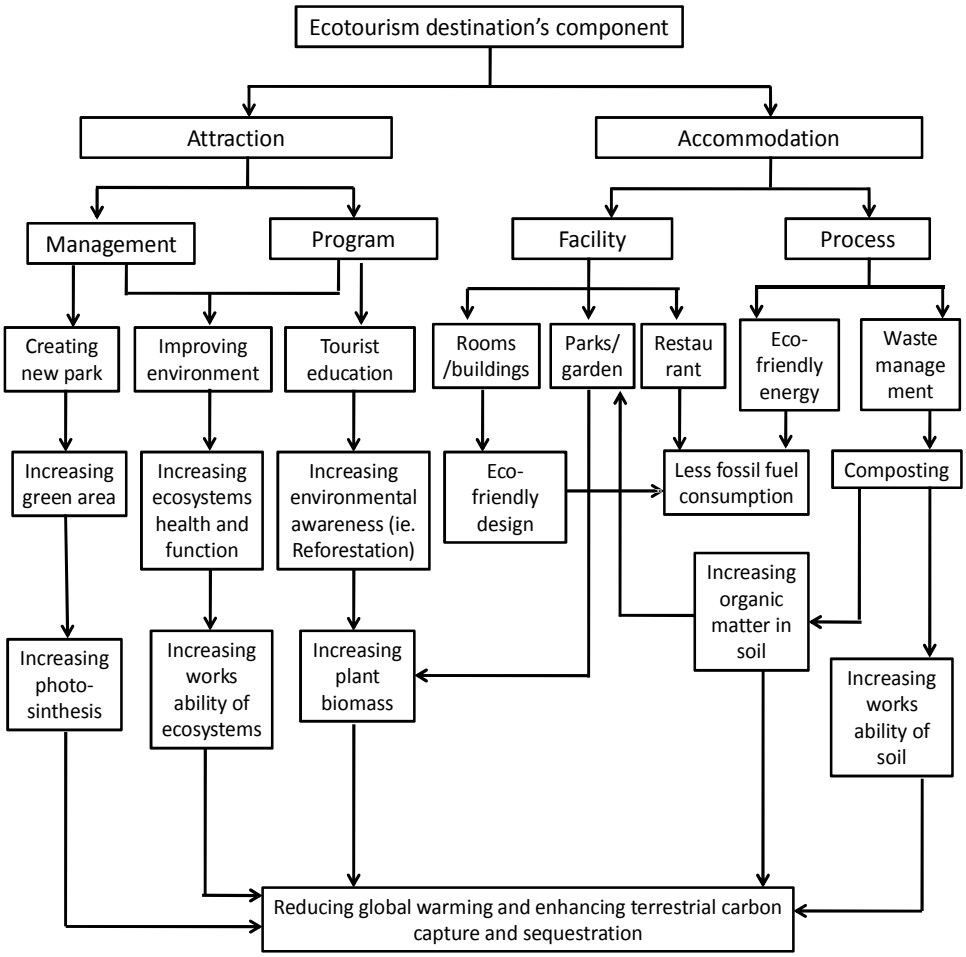

Figure 1. Framework toward sustainable ecolodge in CCS mechanism

-ged to meet global warming reduction principles. Accommodations facility should be build following environmentally friendly design and approach, such as using local material, adopt local building architectures, and provides opportunities for environmental conservation.

The daily activity should be efficient in energy usage and optimizing reuse and recycle approach.

According to Figure 1, there are many benefits of applying efficiency energy and waste management.

CONCLUSIONS

In conclusion, it is clear that ecotourism potential to contribute to carbon capture and sequestration. The potentials principally related to the ability of ecolodge to support conservation programs and efficiency of resources uses. In the limited guidelines on how ecolodege can contributes to the global warming reductions, this paper highlight the important of attraction and development management to meet proper carbon capture and sequestration mechanism. The attraction management and developing programs ultimately able to increase plants biomass while accommodation able to practicing energy efficient and optimizing reuse and recycle approach. In the recent situation where actual action and effective strategy to mitigate global warming increase, and CCS policy become important approach, ecotourism offers the unique opportunities to contribute such needs. It will become the potential solution for reducing greenhouse gas emissions and create clean development strategy.

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