

Eco-pesantren development: The challenges and opportunities of ecological conservation

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ABSTRACT. Implementing green, eco-friendly, and sustainable development is difficult, hence highly dependent on attainable economic profit, and tends to be exploited massively and destructively to attain the desired benefits. It leads to environmental degradation and, consequently, the diminishing of several natural resources. Therefore, an alternative approach involving effective and Islam-based conservation as well as land restoration is required. In this study, in-depth individual interviews on pesantren Al-Zaytun were conducted to collect the qualitative descriptive data, including biotic aspects, such as plant diversity and wastewater treatment in water management and conservation. The results showed the pesantren Al-Zaytun utilized *Tectona grandis* and *Eichhornia crassipes* to carry out land and water management as a sustainable approach to conservation as well as food, water, and energy security development. Therefore, it can become a role model for eco-pesantren development in the modern era, as well as the utilization and management of natural resources for ecological development.

Keywords: dominant species; ecological equilibrium; environmental hazard; ecological investment; eco-friendly development

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INTRODUCTION

Indonesia is a country comprised of the largest Muslims population which preach about the need for an eco-friendly human-nature relationship or interaction to achieve a sustainable equilibrium (Hefner, 2013; Harahap, 2015; Qomar, 2015; Soga & Gaston, 2020). Meanwhile, in the modern era, natural resources are perceived as objects to be massively explored or exploited by human activities to obtain desired benefits which combined with population growth, behavior and lifestyle changes led to land use and land cover change (McShane *et al.*, 2011; Hassan *et al.*, 2016; Wu *et al.*, 2016; Kattumuri, 2018). These problems have become a global issue, and therefore, require an effective solution. Thus, natural resource management and utilization ought to be the attention of all people, especially the central government, to ensure consistent and equitable management, based on environmental laws.

The Indonesia government has set policies regarding the environmental movements as a form of concern for the environment, a balance

between development, quality of life, and sustainable environmental preservation (Kementerian Sekretariat Negara, 2009). Eco-pesantren is an Islamic educational institution that emphasizes activities responsive to the environment, such as environmentally friendly waste management, clean water, and sanitation (La Fua, 2013; Pudjiastuti *et al.*, 2021). Previous studies by Bahri (2018) that the concept implementation of eco-pesantren was successfully applied in pesantren An-Nur HA Rambigundam Jember including planting trees in the barren area, cleared the rubbish, and rehabilitation of the forest. Followed by Quddus (2020), Nurul Haramain NW Lombok Islamic boarding school had implemented a sustainable lifestyle based on ecological values, including tree planting and producing about 1 to 1.5 million seedlings per year distributed to the community.

Plant diversity can maintain ecosystem functions in a habitat (Isbell *et al.*, 2011; Gould *et al.*, 2016). Plant roots can significantly increase soil stability and enhance the soil reinforcement (Fattet *et al.*, 2011; Mao *et al.*,

2013; Le Bissonnais *et al.*, 2018). Water resources and their management are essential aspects to ensure the continued productivity of agricultural land. This study, therefore, aims to highlight the role of the eco-concept in the development at pesantren Al-Zaytun, based on the ecological and Islamic perspectives and the extent of success attained in this development. The study also aims to discover an approach to implement pesantren of Al-Zaytun's strategy in restoring the terrestrial ecosystem to a more wetland or fertile (productive) condition and the impact on the surrounding.

MATERIALS AND METHODS

Study area. Pesantren Al-Zaytun is located in Indramayu Regency, West Java, Indonesia (Fig. 1), in the middle of a farmland site, often referred to as a forest or garden. The Indramayu regency has confronted water unavailability with supporting farmlands (irrigate) in the dry season. Therefore, water resource (availability or stock) management is a pivotal aspect to ensure farmlands (productivity) and other resources (local to national economic development) have access to water (stock), at least at a small scale (Jamban systems) (Kristiyanto, 2021).

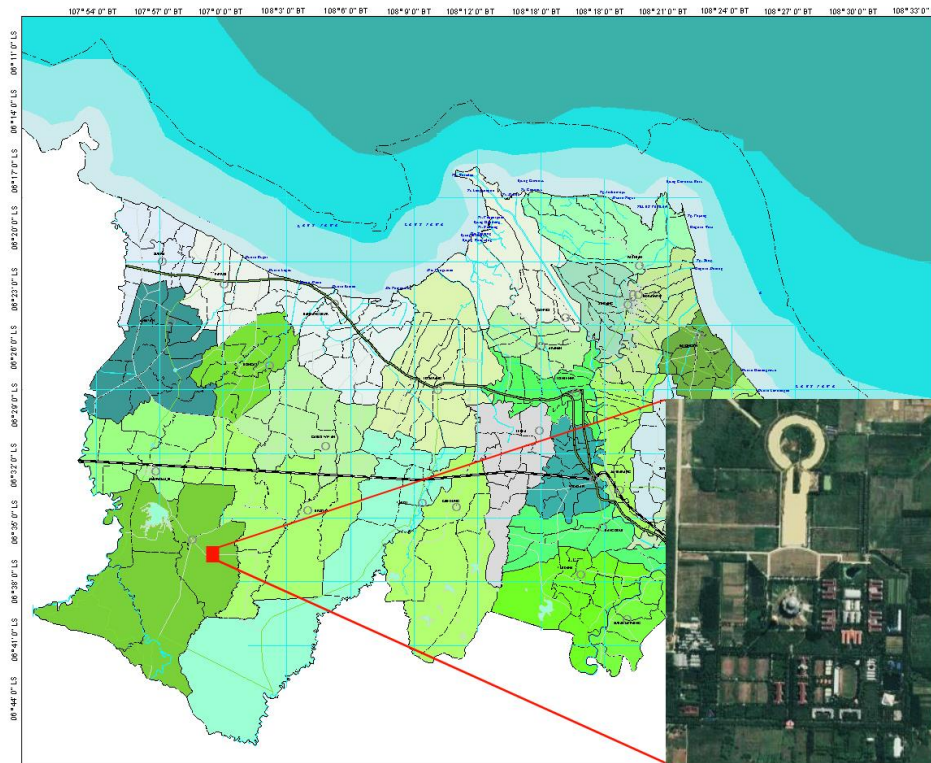


Fig. 1. Location of sampling sites pesantren Al-Zaytun ($6^{\circ}15'6.40''S$, $107^{\circ}52'108.36''E$).

Data collection and analysis. The data, including plant species and wastewater treatment, were collected by in-depth individual interviews on pesantren Al-Zaytun. The analysis involved identifying and interpreting relevant ecological concepts in the interview data (Kelly & Bruen, 2015).

RESULTS AND DISCUSSION

Pesantren Al-Zaytun was established in a land area of at least 1200-2000 Ha. Half of the land is used for farmland, forest, garden, and fourth development and has been utilized to

provide food, water resources, and energy. This type of development is categorized as sustainable based on ecological perspective, green due to the forest's involvement, and also economic to the plant potential generated, for instance, *Tectona grandis* Linn. f.

T. grandis is the most dominant species deliberately cultivated in the forest due to the economic potential and benefits at the local and national levels. In addition, the species serves as natural capital for financial investment, as a sustainable development paradigm used to achieve economic growth and sustainability

goals. Therefore, the pesantren Al-Zaytun was green-designed to achieve sustainable development, where numerous tree or plants species grow around (Fig. 2), providing fresh



Fig. 2. The green development of pesantren Al-Zaytun.

Pesantren Al-Zaytun as ecological investment. The land management and conservation practices carried out by pesantren Al-Zaytun are for preserve and develop the ecosystem. Developing the forest area is also part of the restoration process in improving the ecosystem's stability, which requires water resources (hydrology). A reservoir is one way to manage water conservation development and availability (stock) for hydroelectricity production might support irrigation practices (Seitz, 2011; Zeng *et al.*, 2017). Pesantren Al-Zaytun has been able to conserve the ecosystem as part of the sustainable development paradigm. The area used to be a dry land (barren) and was susceptible to drought occurrence. However, the adaptation and mitigation practices (Fig. 3), including reservoir development, helped develop a sustainable water supply. Thus, the area no longer depends on the rainy season.

Furthermore, the restoration process involving the introduction of various species, including flora and fauna (forest development) indirectly led to the creation of a simplified hydrological design (small reservoir). Numerous ecological functions in the pesantren area were used for irrigation (farmland, garden, livestock, and fort) as well as other purposes,

air, mild, pleasurable nuance, consequently forming an ecological equilibrium, while creating a suitable habitat for plants and animals, to achieve increased biodiversity.

following the words of the Holy Al Qur'an in QS. Al-Baqarah verse 22, 74, 164, and An-Nisa verse 43 (Kementerian Agama, 2019a; 2019b). The creation and development of a water cycle using a reservoir designed is one strategy to revive an ecosystem, to achieve health and ecological sustainability development goals (Spence *et al.*, 2016; Akinsete *et al.*, 2019; Constant & Taylor, 2020). These services to the ecosystem ought to be necessary to ensure the survival of all species (human, plants, animals, microbes). Several forests and reservoirs were deliberately developed to achieve ecological development and restoration (Halme *et al.*, 2013; Ho & Goethals, 2019). Pesantren Al-Zaytun implemented an ecological investment approach based on natural capital and manifestation to sustainable development paradigm, as part of the responsibility to Allah swt in utilizing and maintaining His creation.

Wastewater management (treatment) and conservation. Pesantren Al-Zaytun is located in the middle of dry land or barren area, with low water availability (stock). The rainy season serves as the source of water for irrigation and other daily needs. It becomes a part of the challenges and opportunities to improve the area's water supply while proving the possibility of overcoming water shortage

sustainably and ecologically by utilizing plant species for water treatment at the local, regional, and global levels. The paddy lands are the most prevalent farming lands within the Indramayu regency and the pesantren Al-Zaytun area. Therefore, water resource

availability (stock) has a key role in achieving land productivity, and for this reason, pesantren Al-Zaytun attempted sustainable reservoir development based on wastewater treatment (management) and rainfall (Fig. 3).



Fig. 3. Wastewater treatment and conservation design in pesantren Al-Zaytun: a. Wastewater management; b. The reservoir, dependent on wastewater treatment and rainfall.

The reuse, recycle and reduce approach utilized by pesantren Al-Zaytun to restore water resources while developing the vegetative ecosystem (forest areas). To attain sustainable food and energy security, pesantren Al-Zaytun has adapted and mitigated a watershed or water crisis approach, including reservoir development. Wastewater treatment is one strategy to tackle the watershed (water shortage), by managing wastewater based on ecological principles, for instance, using *Eichhornia crassipes* for filtration or purification purposes (Fig. 3a). According to Kumari & Tripathi (2014) and Mahunon *et al.* (2018), *E. crassipes* might be utilized for the removal organic matter and pollutants from wastewater. Therefore, pesantren Al-Zaytun has successfully managed sustainable wastewater treatment as the primary water source to support rural and urban sustainability, also as a part of a water conservation approach to achieve green development. Wastewater management and water conservation is an ecological investment, practiced with land restoration and conservation to achieve sustainability around the rural area of pesantren Al-Zaytun.

The impact of eco-friendly development on ecosystem stability. The aim of land management or green development (infrastructure) is sustainable forest development or reforestation and land fertility restoration and crop process, to improve the ecosystem and provide benefits for humans, including improved air quality, water conservation, and harvest (Cowie *et al.*, 2011; Hwang & Tan, 2012; Cordingley *et al.*, 2015). Our study showed that numerous plant species had been deliberately cultivated in the forest, garden, and home area, to ensure food, energy security, water security, and resilience in social systems. It has helped to cope with droughts and climate change impacts and achieve forest expansion, land conservation, and increased productivity from an ecological perspective, and this increase in ecosystem stability supports further species growth. Therefore, pesantren Al-Zaytun has successfully restored the ecosystem based on the greenery development paradigms, leading to ecosystem stability. The high biodiversity is also an impact of eco-friendly development and building ecological resilience in terms of capacity and ecosystem services, thus sustaining the welfare of humans.

It is part of the sustainable development goals by green development at the regional scale without leading to environmental or land degradation, and is a concept applied in each religion, particularly Islam.

CONCLUSION

The dominant species found in pesantren Al-Zaytun is *Tectona grandis* to achieve green ecological equilibrium, while *Eichhornia crassipes* are used in wastewater treatment to achieve an eco-friendly and simplified filtration and purification process.

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