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INTEGRATED CULTIVATION OF LAND-SEA ECOSYSTEMS THAT PRIORITIZES HARMONY WITH NATURE AND SOCIETY

Cening Kardi[1*], Putu Fajar Kartika Lestari[2]
[1, 2]Fakultas Pertanian dan Bisnis, Universitas Mahasaraswati Denpasar, Indonesia
Email: lovelycening@unmas.ac.id[1*], pfajarkartika@unmas.ac.id[2]

ABSTRACT

There is an urgent need for aquaculture systems that not only increase productivity, but also maintain ecological balance and improve the well-being of local communities. With increasing pressure on natural resources due to overexploitation, emerging climate change, and global economic uncertainty, new approaches that integrate terrestrial and marine ecosystems are crucial. This research aims to develop an integrated aquaculture model that prioritises harmony between nature and society. This approach incorporates organic farming and mariculture practices, in line with blue economy principles, to create environmental sustainability and social welfare. The research method used was descriptive qualitative, with a focus on mapping specific regional areas consisting of three or four agro-climatic regions. Data were collected through surveys and focus group discussions (FGDs), covering ecological factors such as climate, coastal plain quality, seabed and seawater. Seawater health estimation for mariculture was based on physical, chemical and biological parameters with APHA (1992) guidelines. The results show that this integrated aquaculture can improve environmental quality and productivity of land and sea, while creating harmony between natural resource management and social welfare. This model provides a practical solution to achieve sustainable development.

KEYWORDS ***Integrated cultivation, Harmony, Organic farming, Marinculture, Blue economy, Land-Sea Ecosystems.***

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INTRODUCTION

Land-sea ecosystem management plays an important role in maintaining the sustainability of natural resources that support human life. These ecosystems involve complex relationships between biological, physical and socio-economic components, which influence the dynamics of resources on both land and sea (Barceló et al., 2023). An integrative approach to land-sea ecosystem management is needed to maintain a balance between economic growth, social welfare and environmental conservation, in line with the sustainable development goals (SDGs 2030). This balance is an important step in addressing global challenges such as climate change, ecosystem degradation and biodiversity decline (Liang & Li, 2020).

In addition, interactions between land and sea in ecological and socio-economic contexts must be managed wisely to minimise the negative impacts of human activities on the environment. Economic activities such as agriculture, fishing, tourism and industry in coastal areas often contribute to pressures on ecosystems, which if not managed sustainably can cause long-term damage (Innocenti, A., & Musco, F., 2023). Therefore, it is important to create integrative strategies that harmonise land-sea ecosystem management with sustainability principles that can provide long-term benefits for nature and society.

An integrative management approach must also take into account the needs of communities living around land-sea ecosystems. The involvement of local communities in decision-making and policy implementation is a key element in achieving successful sustainable management. Community empowerment through environmental education, capacity building, and access to sustainable resources can increase their awareness and participation in maintaining ecosystems (Uralovich et al., 2023). Thus, harmony between nature and society can be realised, where human needs are met without damaging the environment that is the source of life. Overall, integrative land-sea ecosystem management requires a multidimensional approach that considers ecological, social and economic aspects in a balanced manner.

Previous research conducted by (Kardi et al., 2021) stated that aquaculture in Gerokgak district is in line with the principles of blue economy, combining ecological and socio-economic determinants of the community in resource management. The natural and cultural beauty of the coastal area makes Gerokgak attractive for eco-marine tourism. The development of this destination should involve a community-based approach and support from all stakeholders to build a marketable tourism village. In addition, it is important to adhere to tourist safety policies, create a clean culture, and increase hospitality among tourism actors. Although the threat of environmental

damage has not yet emerged, integrated control and anticipation are necessary to support the sustainability of aquaculture and eco-marine tourism in the future.

This research offers a new approach to land-sea ecosystem management through the mapping of agricultural potential integrated with agro-climatic conditions in each target location. In addition, the research incorporates analyses of biophysical and socio-economic characteristics as a basis for strengthening sustainable agricultural development in the region. The novelty lies in the development of an integrated cultivation model that prioritises harmony between nature and society, which has not been widely explored in the context of comprehensive land-sea ecosystem management. This model is expected to be an innovative solution to achieve sustainable development in coastal areas with an integrative approach. The objectives of this research are to (1) map the agricultural potential of farming communities in each destination in accordance with the agro-climatic area, (2) analyse the biophysical and socio-economic characteristics that support agricultural improvement in each destination, and (3) formulate an integrated cultivation development model for land-sea ecosystems that prioritises harmony with nature and society.

RESEARCH METHOD

The research method used was descriptive qualitative, which began with mapping specific regional areas to be included in the integrated cultivation of land-sea ecosystems. This area includes three or four agro-climatic regions that have different characteristics. Data was collected through field surveys and focus group discussions (FGDs) involving relevant stakeholders. The data collected included ecological factors relevant to sustainable development, such as climate, coastal plain, seabed and seawater quality. In addition, the estimation of the health of seawater used for mariculture included physical, chemical and biological parameters, which were measured based on APHA (1992) standards. Measuring instruments in accordance with these guidelines were used to ensure the accuracy of the environmental quality data. The results from this survey and FGDs were analysed using data tabulation, descriptive analysis, and narrative to generate relevant findings.

RESULT AND DISCUSSION

Agricultural businesses that utilize ecosystems on land do not fulfil the green economy

Agricultural businesses that utilise ecosystems on land do not fulfil the principles of a green economy, but this can be rectified through integrated land-sea ecosystem

farming that prioritises harmony with nature and society (Mariyono et al., 2021). This aquaculture concept includes harmonious farming practices between on-land activities and utilising marine resources, thus creating a balanced ecosystem (Cavalli et al., 2021). With this approach, farmers can utilise natural resources sustainably, reduce dependence on harmful chemicals, and improve soil and water quality. In addition, integration between land farming and marine fisheries can increase biodiversity, which is important for maintaining ecosystem health (Nugraheni, 2014).

Community well-being is also a key focus in integrated land-sea ecosystem farming. This practice encourages community participation in resource management so that they can directly benefit from agricultural and fishery products (Kardi et al., 2015). By prioritising the whole ecosystem and social sustainability, farming can reduce negative environmental impacts while improving people's lives. For example, by adopting organic farming methods and environmentally friendly fish-rearing techniques, farmers can produce healthier and higher-value products (He et al., 2021).

Integrated land-sea ecosystem farming offers a solution to the challenges traditional farming enterprises face that do not fulfil green economy principles (Soto, 2009). By promoting a balance between agricultural and marine activities, this approach not only protects the environment but also strengthens local economies and improves food security. Through this sustainable and harmonious practice, communities can develop a more sustainable way of life in harmony with nature (Lorenzen, 2015).

The subak ecosystem and culture can support organic-based farming on land well. Agricultural enterprises that utilize ecosystems on land often do not adhere to the principles of green economy, which emphasize sustainability, resource efficiency, and environmental protection (Vipriyanti, 2014). Conventional agricultural practices frequently rely on the use of chemicals, such as synthetic fertilizers and pesticides, which can harm soil and water resources. Therefore, there is a need for alternative approaches that are more environmentally friendly, such as integrated terrestrial aquatic ecosystem cultivation. This approach combines agricultural activities with the utilization of marine resources, creating synergy between both sectors and maintaining ecosystem balance (Astarini et al., 2020).

Integrated terrestrial-aquatic ecosystem cultivation focuses on environmental sustainability and enhances community welfare. By involving local communities in resource management, they can contribute to more sustainable practices and directly benefit from agricultural and fisheries outputs. This method helps improve product quality, such as healthy and high-value food while preserving biodiversity. Thus, the integration of agriculture and aquaculture has the potential to address the challenges

faced by traditional agricultural enterprises while strengthening local economies and food security.

To effectively advance organic farming, several important initiatives need to be implemented. This includes investigating the biophysical properties of soil that are appropriate for organic methods, providing suitable technological support for rice farming based on organic practices, and ensuring that Subak independently supplies high-quality seeds and organic fertilizers. Moreover, the customary laws (Awig-Awig) of Subak should integrate regulations and penalties to address pollution caused by pesticides and waste in irrigation channels and rice fields, with stringent consequences for noncompliance. These laws should also protect agricultural land from being converted to non-agricultural uses and prevent the spread of pests and diseases in plants and animals. Finally, continuous participatory evaluations with all involved parties are essential for enhancing awareness of the importance of organic agriculture and food security in Bali.

Aquacultural businesses that utilize ecosystems on the coast and sea

Marine aquaculture businesses in Gerokgak District have fulfilled the principles of the blue economy in terms of ecological and socio-economic determinants of the community in managing aquaculture resources (Kardi & Wiasta, 2019). The potential, along with the natural landscape, culture, and customs in the coastal and marine areas of Gerokgak District, are truly beautiful and attractive to be designed into environmentally friendly marine aquaculture tourism. The arrangement and management of marine aquaculture tourism should be based on an open and intuitive type to build destinations integrated with the configuration of life, space, and models according to the community of origin (community-based tourism) (Kardi & Wiasta, n.d.).

To foster a marketable marine cultural tourism village while establishing a learning ecosystem aligned with the "Independent Campus-Independent Learning" initiative, collaboration among all stakeholders, academics, government, businesses, and the community is essential (Ricca et al., 2020). An integrated companion fund program can facilitate this collaboration, enabling the development of sustainable tourism practices that benefit both the environment and the local economy. It is crucial to adhere to established policies regarding tourist destination security, promote a clean and healthy culture (which includes maintaining the quality of marine waters for aquaculture), and enhance the hospitality of tourism operators (Gunn & Var, 2002).

The implementation of these policies should be explicitly outlined in customary regulations or awig-awig of coastal villages to ensure local governance and community participation. By doing so, these efforts can strengthen the Nyegara Gunung culture in

Bali, which emphasizes the relationship between the sea and the mountains, reflecting the island's unique heritage (Achiar et al., 2018). This holistic approach enhances the reputation of marine aquaculture tourism destinations and contributes to the preservation of cultural values and environmental sustainability, thereby promoting long-term benefits for local communities and the ecosystem (Singh et al., 2021).

While serious environmental damage threatening marine cultivation in Gerokgak District has not yet manifested, proactive, integrated control and ongoing preventive measures are essential to developing sustainable aquaculture tourism. This involves establishing a comprehensive framework that prioritizes the health of marine ecosystems while supporting local economic development. Continuous monitoring and adaptive management strategies can help ensure that aquaculture practices do not adversely affect water quality or biodiversity in the region (Mahardika et al., 2021).

To further enhance sustainability, additional research is necessary to explore effective methods and installations for managing liquid waste generated by aquaculture activities. By adopting innovative waste management solutions, stakeholders can maintain high water quality, which is crucial for the success of marine cultivation in Gerokgak District. This commitment to responsible practices will not only support the health of the aquatic environment but also contribute to the long-term viability of aquaculture tourism, ensuring that it remains a valuable resource for future generations (Hamzah & Khalifah, 2009).

The model for the development of integrated cultivation of land-sea ecosystem with harmonious priorities

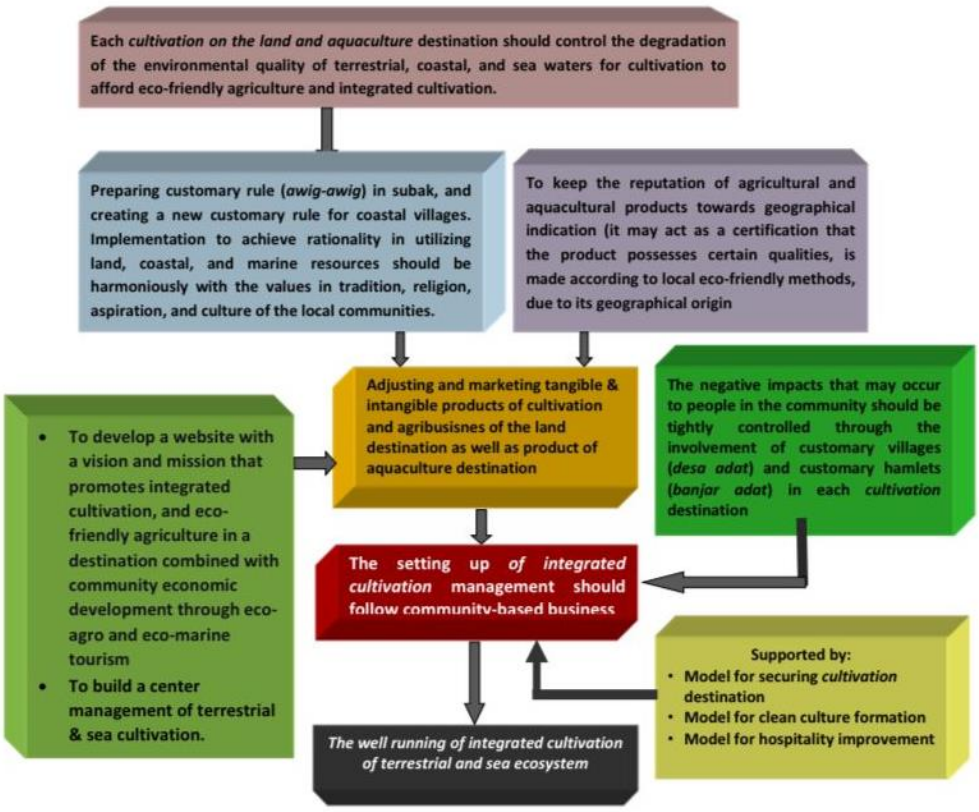

Figure 1. The Model Fordevelopmentof Integrated Cultivation of Terrestrial-Sea Ecosystem with Harmony Priorities

The image illustrates a model for the integrated development of land-sea ecosystems, focusing on harmonious and sustainable priorities. The model aims to prevent environmental degradation on land, coastal areas, and seas through eco-friendly cultivation practices. Land and natural resources must be used wisely, in alignment with local traditions, religious values, and cultural aspirations, governed by customary laws (awig-awig). This ensures that resource use in agricultural and coastal areas is balanced to preserve ecosystems while maintaining local communities' social and cultural aspects.

Additionally, the model emphasizes the importance of maintaining the quality and reputation of agricultural and aquaculture products through geographical indications. These certifications assure that the products are produced using environmentally friendly methods specific to their region of origin. To maximize these products' potential, marketing strategies and adjusting both tangible (physical) products, like crops, and intangible products, such as agribusiness services, are necessary.

Customary villages (desa adat) and customary hamlets (banjar adat) play a crucial role in managing any negative impacts of cultivation activities on local communities, ensuring the balance of socio-economic conditions and cultural preservation.

Integrating cultivation management should be community-based, allowing local involvement in ecosystem management. Key support for the success of this model includes developing a website to promote sustainable cultivation, establishing a management center for both terrestrial and marine cultivation, and implementing models to secure cultivation destinations, promote clean culture, and enhance hospitality. With this integrated approach, the harmonious and sustainable management of land-sea ecosystems can be achieved, benefiting both the environment and local communities in the long term.

CONCLUSION

Agricultural businesses that rely on land-based ecosystems often fail to meet the principles of the green economy, which emphasize sustainability, resource efficiency, and environmental protection. Conventional agricultural practices, such as the excessive use of synthetic fertilizers and pesticides, contribute to soil degradation, water pollution, and biodiversity loss. However, these challenges can be addressed through integrated land-sea ecosystem farming, which harmonizes agricultural activities with marine resource utilization. This integrated approach, supported by local customs (awig-awig) and traditional ecological knowledge, promotes sustainable farming practices that reduce dependence on harmful chemicals, enhance biodiversity, and improve environmental health. By involving local communities in the management of these resources, the model not only helps protect ecosystems but also strengthens local economies, improves food security, and contributes to a healthier, more balanced environment, aligning with the goals of the green economy.

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