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TAY JUHANA FOUNDATION

Suboptimal Land Series - Part 5

Enhancing Climate Change Resilience in Coastal Suboptimal Agriculture

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- Coastal suboptimal covers around 7.5 million hectares of Indonesia lands. It delivers a significant contribution both on aquaculture and agriculture.
- Climate change affected farming activities in nearly every part of the globe. The harvest yield might drop around 10-50% by 2030, including in coastal farms.
- Mangrove conservation is the key component to sustain the farming as well as enhancing the farmers climate resilience.
- Multiple Climate Smart Agriculture adaptation strategies such as Low External Input Sustainable Agriculture, Coastal Field School, and silvofisheries can be options to be further developed and embedded in the government climate action agenda.

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What is Coastal Suboptimal's Agriculture?

In the previous TJF Brief edition, coastal suboptimal land was defined as a type of land that is characterized by inundation and contains saline water. The term "suboptimal" in coastal areas because it is more difficult to do agricultural practice compared to upland regions because they need to cope with change in salinity, tidal inundation, water stresses, and pyrite poisoning. It is estimated that 7.5 million hectares of Indonesian lands are coastal suboptimal (Mulyani et al. 2016). As an archipelagic country, most regions in Indonesia have coastal resources that hold important support on food security. Agriculture and aquaculture sectors generate important contributions to food production, economy, and social development.

In practice, coastal areas are not only for agriculture but also for aquaculture. The distinctive use of both practices are determined by different soil characteristics. For example, a group of fluvio-marine landforms in the delta area and estuary plain. The estuary brought the sediment and deposited by the rivers, creating marine alluvium soil. Hence this soil is a combination of sand, silt and clay, or only mud in the mangrove ecosystem. This soil type is compatible for aquaculture use because of inundation by brackish or seawater.

Meanwhile, there is also a group marine landform in the sandy coastal area, lagune, and tidal plain. This type of landform is dominated by sand soil and not inundated by water or far away from

rivers. Though the sandy soil has high porosity and difficult to bind nutrients, it is still workable for agricultural purposes.

This article highlights multiple methods that align with the Climate Smart Agriculture (CSA) principles to showcase coastal farmers' adaptation effort. CSA is not a specific technique, but rather an approach to identify existing production systems that can best respond to the impacts of climate change (FAO, 2017). It can be embedded in many different methods as long as it improves crop production while avoiding further losses in the carbon that is currently stored in soils, trees and coastal ecosystems.

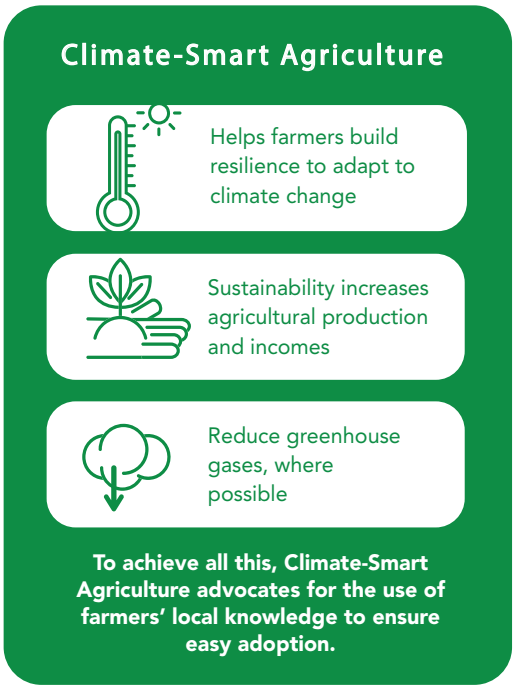

Figure 1. CSA from the FAO can be adopted in large scale of coastal agriculture for increasing resilience of climate change.

Sustaining the Food Production in Coastal Suboptimal Areas

Shoreline areas have long been becoming the source of livelihood for the coastal communities. Giri et al. (2008) found 63% of existing mangrove forest is utilized for aquaculture, followed by 32% and 4% for agriculture and urban development, respectively. Unfortunately, most of the practices are not equipped with strict regulation and adequate knowledge that prioritize the long term benefit that can be resulted from a healthy coastal ecosystem.

Around 600,000 ha of mangrove forest in Indonesia has been severely degraded due to aquaculture farming (Ilman et al. 2016). In Central Java, 20 km of coastline has eroded because of floods and land subsidence (Marfai, 2011). On the other hand, agricultural activities in this type of land also demand for large amounts of fertilizer because soil conditions are unfavorable for plants to grow well. To support farming practice, soil improvement is necessary through increasing aggregate of soil and improving the nutrient content.

Various approaches have been employed to sustain the conservation and food production. In the agriculture sector, LEISA (Low External Input Sustainable Agriculture) method is known for its integrated system that harmonizes livestock and farming (Fadilah et al. 2020). The compost from livestock is used for fertilizer, and the farming waste can be processed to feed the livestock. The practice will reduce the cost for land preparation and maintaining the source of organic fertilizer.

For generations, coastal farmers have passed down local wisdom to cultivate these areas. The knowledge has evolved through the combination of scientific workshop, technology, adaptation, and informal knowledge sharing. In Purworejo Regency, Central Java, the coastal community has utilized inherited knowledge for farming in sandy soil conditions (Kusumaningrum & Widiyantono 2018). The practice has become their income source as it is able to help them meet the household needs. Most of the commodities are horticulture plants such as chili, tomatoes, eggplant, and peanuts. They also cultivate staple food, especially rice and corn.

Similar farming is found in Pacitan and Sidoarjo coastal areas, a regency in East Java. Rice is highly adaptive in the coastal lands, followed by horticulture (Maroeto & Sasongko 2004). Aquaculture farming in fluvio-marine landform also delivers a vast amount of seafood commodities including milkfish, crab, tiger pawn, oyster, and cockles. Central Java Province is the largest producer of aquaculture products, and in 2017 produced 500,000 tons yields (BPS Jawa Tengah 2019).

Figure 2. Silvofishery: mangrove plantation side to side with pond embankments (Hastuti & Hastuti 2017)

Climate Change Resilient Coastal Agriculture

Climate change affected agriculture in nearly every part of the globe. Without proper adaptation, it might drop the harvest yield around 10-50% by 2030 (Challinor et al. 2014). The effects include drought, subsidence, flooding, and erosion as happened in Mekong Delta, Vietnam, which is one of the world's largest rice producers. In Indonesia, the food production largely relies on Java where 51% or 10.6 million hectares of paddy fields are located on this island (BPS 2020). However, the region is facing problems with land availability for farming that is driven by land conversion to infrastructure development.

The existing agricultural fields are also at risk of climate change impact in many ways, such as precipitation change, longer drought period, and temperature change. This challenge even hit coastal areas harder where it is home to half of the island population.

The climate change effect is more visible in coastal regions since sea water level rise, abrasion, and sea water intrusion have affected the farming areas. The shoreline in northern Java Island, which is a plain and productive area for rice farming, has been polluted with sea water intrusion.

In Indramayu District of West Java, more than half of the paddy fields have higher salinity ranging from 1.37 to 16.38 dS/m (Erfandi & Rachman 2011). If the salinity exceeds 1.9 dS/m, it can reduce rice productivity (Grattan et al. 2002). In Demak regency of Central Java, the combination of sea level rise and subsidence of up to 17.91 cm/year (Yuwono et al. 2019) has worsened the farmers' condition because it means they lose their main livelihood. Furthermore, climate change has affected agriculture in coastal areas around Indonesia, and will have severe consequences on food security in near future. The tidal flooding in Demak coastal areas destroyed the farmers' milkfish pond; as result they lost main

Story from the Field

Abdul Ghofur, Aquaculture Farmer in Demak

Women farmers in CFS activities in Demak

Pictures ©Blue Forests 2019

Aquaculture largely depends on a healthy coastal ecosystem to be resilient. A farmers development program such as Coastal Field School (CFS) can be implemented. It aims to build the capacity of small-scale aquaculture farmers to better manage their coastal resources within their own specific agro-ecosystem (Qurani et al. 2021).

Abdul Ghofur is an aquaculture farmer in Demak coastal areas. He is one of the farmers that are affected by climate change, combined with unsustainable practice on their ponds. Previously, he learned from his neighbor that was already successful in shrimp farming. Without proper knowledge, he used chemical fertilizer on his ponds, but the yield wasn't as expected.

In 2015, for the first time he joined CFS and learned about organic practices of aquaculture farming. He is glad that the knowledge helped him to intensify the harvest every 2.5 months. Now he understands more about the shrimp disease and how to prevent it. His awareness on the importance of mangrove forest has improved especially to maintain the healthy ecosystem for aquaculture.

livelihood (Asrofi et al. 2017). Farmers' income in this area decreased up to 79% because of climate change impact (Ismail et al. 2012). If this trend continues, the food security system in the near future will be disrupted.

Among others, enhancing agriculture resilient to climate change can be implemented by improving the seed quality as well as employing mangrove-based aquaculture called silvofisheries. Stress tolerant rice varieties that are adaptive to saline conditions can support sustainable development in coastal's agriculture (Rumanti et al. 2018). For example, Inpari 34 & 35 seeds are relatively tolerant to salinity. These varieties have yield potential up to 8.3 ton/ha. Hence, once the paddy field is affected by the tide, the rice productivity would remain stable.

However, high quality varieties will hardly survive without healthy mangrove forests. The mangrove greenbelt has the ability to minimize seawater intrusion to the agricultural field (Hilmi et al. 2017). One method for sustainable aquaculture farming is silvofisheries. Silvofisheries offer a more integrated approach where the mangrove trees are planted alongside the aquaculture ponds to imitate the natural habitat (Ahmed et al. 2018). In Mahakam Delta, East Kalimantan, the application of integrated aquaculture with 30-50% mangrove cover has increased the yield of shrimp farming (Rimmer et al. 2013). The leaves of mangrove trees enter the detritus pathway and substantially contribute to aquatic food webs supporting fisheries production (Hutchison et al. 2014).

Moving Forward and Recommendation

Climate-resilient agriculture is an approach to maintain sustainability of long-term farming production under climate variabilities. It also means helping prevent crop failure that harms food stock as well as farmer welfare. Beside research and development on agriculture, building the capacity of farmers is equally important for sustainable food production. Our latest research shows intervention on farming capacity can increase productivity and long-term sustainable production without harming the mangrove ecosystem (Qurani et al. 2021)

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As a country with more than 17,000 islands, Indonesia needs to ensure that coastal farming will thrive in the face of climate change. Multiple CSA-based adaptation strategies such as LEISA, CFS, and silvofisheries can be options to be further developed and integrated in the government climate action agenda. It is a call for the related stakeholders to take action which involve adaptive farming, farmers capacity development, and integrated coastal management.

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ABOUT TJF

Tay Juhana Foundation (TJF) is a nonprofit organization dedicated to promote the advocacy of the conversion and cultivation of suboptimal lands into productive lands, through the most environmentally, economically, and socially sustainable manner.