Mainstreaming sustainable use of suboptimal lands to support food security in Indonesia

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Abstract. The majority of land types in Indonesia consist of suboptimal lands. Their conditions are either too dry (i.e. acidic dryland, arid land), or too wet (i.e. swamps, peatland). This made the soil fertility low, highly acidic, and more costly to be managed. Despite the circumstances, suboptimal lands hold a significant contribution to support food security especially in the provinces where these land types share a large distribution. While the existing agricultural policies and practice tend to overlook the lands’ potential, this research attempted to offer a framework to mainstream the sustainable use of suboptimal lands and ways to embed them further into the nation’s development agenda. This paper adopted the Sustainable Land Management Mainstreaming Tool and used a qualitative descriptive approach to gather data and analysis based on literature study. It explored five key aspects that determine the viability of the mainstreaming effort: policies and regulations, incentives and financing mechanisms, land-use and territorial planning processes, and farmers development. Recommended policy options thus generated from each aspect and assessed using change space parameters that divided the result into high-priority, game-changing, and supplementary policies to mainstream the suboptimal land agriculture.

1. Introduction

Security can be defined as “the state of being protected or safe from harm” [1]. In the food security context, it refers to the condition free from hunger or malnutrition. Food security is essential for national security, because people could die from hunger, create conflict, or drive political and economic instability. The COVID-19 pandemic shows the vulnerability of our food system when food exported nations ban their food export [2]. In geopolitical perspective, securing food resources is increasingly important in the midst of unprecedented global threats including climate change, pandemic, food crisis, water scarcity, supply chain disruptions, and decreasing arable lands. Following these challenges, concerns about food insecurity became prominent among countries with deficits of agricultural capacity [3]. The middle and high income countries such as the UAE, Singapore, EU Nations, Singapore, and China have been securing the food supply through land-acquisition and trading schemes that frequently take place in developing countries, including in Indonesia [4].

Today’s agricultural production may not be able to meet the future demand for staple food such as rice, soybean, and wheat; especially in climate change conditions [5]. To improve food security, one of the options is to strengthen self-sufficiency in food production to reduce the nation’s dependency on food import. The Indonesian government has long been employing a series of programs and regulations to secure the food supply. These include land intensification and extensification, food...
diversification, increase regional food stock, reform the supply chain system, and enhance agricultural data management [6].

It is estimated that Indonesia needs at least 10 million ha of crops to achieve food self-sufficiency in 2045 [7]. This number is challenging to attain considering the alarming rate of crops land conversion for housing and infrastructure, especially in the arable land areas. While the conversion rate has reached 96,500 ha/year, the government can only generate new crop lands of 20,000-30,000 ha/year [8]. Other than strictly controlling the land conversion, this staggering gap can also be met by sustainably utilizing the suboptimal lands. This type of lands are largely neglected due to their soil characteristics that are below an optimal level for growing crops or severe limitations for agricultural use. Their conditions are either too dry (i.e. acidic dryland, arid land), or too wet (i.e. inland swamps, peatland). Ergo, they are also known as marginal land, abandoned land, or critical lands.

Despite the soil characteristics, a study revealed that there are around 29 million ha of suboptimal lands that are compatible for agricultural purposes [7]. However, lack of knowledge, infrastructure, and technology hindered the developmental effort. Suboptimal lands have been understudied and thus only gain little attention to decision-makers. One of ways to advocate the land's critical contribution to support food security is by mainstreaming the sustainable use of suboptimal lands in the government’s development agenda.

To ensure the feasibility of suboptimal land utilization, this study also offers a Sustainable Land Management (SLM) framework that can be used for integrating stable food production and safeguarding the environment [9]. SLM basically refers to the use of sustainable approaches on managing land, safeguarding long-term benefit to humans, and maintaining environmental function are important in agricultural development and practices. Mainstreaming sustainable use of suboptimal land is viewed as integration and scaling up of sustainable practice to a wider level of intervention. This paper will firstly identify the main barrier of SLM, analyze the possible policy options, and assess them to determine which policies or programs that the government, particularly the Ministry of Agriculture (MoA) need to be prioritized.

2. **Method**

To identify the main barriers to SLM, we conducted literature review and meta-analysis to explore five key aspects that determine the viability of the mainstreaming effort: policies and regulations, agricultural agenda, investment and financing mechanisms, land-use, and farmers’ development.

In terms of policies and regulation we looked up governmental decree or law that regulate the food production in Indonesia. This analysis is related to Indonesia’s or regional agenda on the agricultural sector for improving food security, as well as the financing mechanism to achieve desirable outcomes from current policies. For land-use and territorial planning processes we examined spatial and regional planning and its intersection between related ministries. As for farmers’ development, we selected the most prevalent issues that hampers farmers to thrive in suboptimal lands. These four factors are drawn from the Sustainable Land Management Mainstreaming Tool framework in the following figure.

![Mainstreaming Strategies](chart.png)

**Figure 1.** The concept of mainstreaming suboptimal land. Modified from Fegan (2019) [9].
3. **Result**

In contrast with popular belief that deemed Indonesia as an agrarian country with abundance of fertile soil, the suboptimal lands are, in fact, heavily dominate the land types in almost every region as it covers 78.2 percent of the land area of Indonesia [10,11]. Their enormous distribution can be seen in the figure 2 below.

![Distribution Map of Suboptimal Land Types in Indonesia](image)

Figure 2. Distribution Map of Suboptimal Land Types in Indonesia [10].

The map indicated that various types of suboptimal lands which include acidic dryland (108.8 million ha), arid land (13.3 million ha), swampland (11 million ha), inland swamp (9.3 million ha), and peatland (14.9 million ha). Given the large land areas, it is such a prudent step to provide higher resources and effort in involving them into the long term food security work plan.

We identified the main obstacles of mainstreaming sustainable use of suboptimal land in Indonesia using five key aspects: policies and regulations, agricultural agenda, investment and financing mechanisms, land-use, and farmers’ development. The comparison between the current situation and main barriers is described in the table below.

**Table 1. Current situation and main barriers of key aspect mainstreaming sustainable land management**

| Key aspect                  | Current situation                                                                 | Main barrier                                                                                   |
|-----------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Policies and agricultural agenda | ● Indicate interest in enhancing food security  
● Initiate better execution of food estate  
● 75 dams was built to enable irrigation | ● No specific agricultural work plan that explicitly mentioned sustainable practice in suboptimal land (wetland and dryland) in the Indonesian regulation  
● Not yet adapt with climate change condition |
| Investment                  | ● Incentive for farmers who join the LP2B program  
● Micro credit for farmer and loans for farmers  
● Direct cash assistance                   | ● The incentive program have sluggish progress and well informed farmer below 40 percent  
● Low percentage of farmers that managed to access the credits and loans |
| Land use planning           | The government have designed land use                                             | ● Unsynchronised between national                                                             |
### Key aspect

| Current situation | Main barrier |
|-------------------|--------------|
| planning both in mid-term to long-term | planning and local planning |
| ● Overlapping land status and permits | ● Overlapping land status and permits |
| ● Implemented multiple empowerment programs such as farmers’ workshops, equipment assistance, and subsidies. | ● Land tenure and social conflict |
| ● Increase the crops productivity | ● Low farmer capacity and technology application |
| ● Ineffective assistance | ● Ineffective assistance |

#### 3.1. Policies and regulations

In terms of agricultural agenda, the current government has shown clear interest in improving food security. In 2015, the MoA formed the Food Security Agency as well as built around 75 dams across the country to enable crop irrigation, especially in the dryland areas [12,13]. The President also issued a Government Regulation No. 17/2015 on Food Security and Nutrition to ensure food availability and prevent food crisis. However, those regulations lack focus on effort to sustainably utilize suboptimal lands particularly in the regions where they share a large distribution of these land types.

Often times, the existing policies use a more popular term such as marginal, critical, abandoned, or degraded lands that deemed for supplementary areas to support food production. Although the used terms tend to imply the low value of these land types, the government has indicated a strong commitment in protecting and restoring the lands to be productive ones. As underlined in the Law No. 37 Year 2014 on Land and Water Conservation, the degraded and critical lands can be restored through agronomic methods that generate food production along with economic benefit for the community. This showed an opportunity for suboptimal lands to be managed using agronomical approach.

Since the past decades, the government has been developing a food production center area or also called Food Estate in multiple regions across Indonesia. This program is viewed as controversial due to their location, unclear development process, and questionable harvest productivity level. On the other hand, Food Estate may work to become a long-term solution if it is located in the suboptimal land areas that are compatible for agriculture, free of conflicting land ownership and status, and take SLM principles into account.

Specialized policies are needed on every suboptimal land type to ensure their sustainable practice. Because each specific land needs different treatment to each other. Unsynchronized and not integrated policies and agricultural guidance lead to continually unfit practice and even repeated program failure. Especially in climate change conditions, these policies should adapt to prevent potential crop failure or degraded land.

#### 3.2. Investment

The effort in mainstreaming sustainable use of suboptimal land should be integrated with the fiscal instruments to ensure the program effectiveness as well as to attract farmers’ participation. Under the Law No.12/2012 on Sustainable Food Farming Land (Lahan Pertanian Pangan Berkelanjutan [LP2B]) outlined the incentive that will be provided for the farmers who join the LP2B program. The incentive includes:

1. agriculture infrastructure development,
2. financing research and development of seeds and superior varieties,
3. easy access to information and technology,
4. provision of agricultural production facilities and infrastructure,
5. guarantee for the issuance of land certificates on LP2B, and/or
6. award for high achiever farmers.
However, the program and incentive socialization has shown sluggish progress where farmers in many regions across the country were not properly informed. A survey conducted in multiple cities revealed that the number of farmers that were aware of the LP2B program were only 22% in Majalengka, 40% in Tasikmalaya, and 20% in Serang. Conversely, a positive result came from NTB province where 100% farmer respondents confirmed that they obtained LP2B socialization from the local government [14].

Thus, the LP2B does not specifically regulate the incentive scheme for farmers who live in the suboptimal lands despite the fact that these land types require more resources to be converted to productive lands. With the abundance of abandoned and marginal lands that are compatible for agriculture, a tailored fiscal instrument can be implemented to accelerate these lands’ contribution to strengthen food security.

Other than incentive programs, financing instruments such as soft loan or micro credit have long been implemented to assist the farmers in obtaining their capital. Yet, multiple challenges still hinder their access to these funding. The absence of collateral like land certificates and the rigid bank’s risk assessment process are among the major bottlenecks that need to be addressed. A research suggested that only 15% of farmers that have accessed the bank credit loan and 33% utilized the state-based agriculture financing from The National Program for Community Empowerment (Program Nasional Pemberdayaan Masyarakat Mandiri) and People's Business Credit (Kredit Usaha Rakyat). Meanwhile, 52% of the farmers are still relying on their own financial resources, cooperation (koperasi), family assistance, and other non-banking institutions [15].

3.3. Land-use planning
The barrier of mainstreaming sustainable use of suboptimal land in land-use planning parameters lies on unsynchronized between national planning and local planning [16]. In most cases, conflict of interest becomes the main barrier on land-use strategies, especially in support of agricultural development. Land use planning is more about politics, both at the national level to detail level. Sometimes the result is overlapping land status and permits. Besides, the utilization of protected areas for farming gains protest, even the use marginal land only provides 7.9 million hectare [17]. The available land cannot suffice the need for food supply in 2045. Hence the land use planning should assess suboptimal land areas and their feasibility for agriculture conversion.

Technically, beside the soil biophysical aspect that affects the land suitability for agriculture, there are many other considerations to determine whether a particular landscape area may be converted into a crop field or not. These include (a) land status, (b) administrative area (location), (c) availability of manpower, and (d) availability of infrastructure for procurement of inputs and distribution of outputs farming, and (e) chances of being converted into agricultural land in relation to spatial planning (land use for development settlements, cities, forest conservation, etc.) [18]. These considerations can be incorporated during the assessment to identify the compatible location for the new crop lands.

The challenge also comes from the lowering numbers of farmer generation. It would be hard for them to even meet the basic household needs if they only rely on small farming area. On average, Indonesian farmers are only own less than two hectares of land which result in little harvest productivity. This put them in financial difficulties since they can only little earning from small farm.

3.4. Farmers development
Suboptimal land agriculture requires a more advance technology, higher cost, and pose a bigger risk in land management, especially if it is located in peatland area. Farmers could trigger fires if they conduct land drainage and slash and burn practice. Therefore, an extensive capacity empowerment program should be put in place to train them in managing proper land management, and cropping methods. Farmers' root problem also comes from inaccessible capital and the rampant middlemen that put them in a large debt. The absence of crops insurance also worsens the situation. Farmers do not
have a safety net whenever the harvest failure hits. It takes rigorous political and economic support to provide the necessary means such as farming infrastructure, cops insurance, knowledge and skill improvement to enable farmers to sustainably manage the suboptimal lands.

4. Discussion

4.1. Influencing the decision-making processes
The government has specified the formal decision making process to form the agriculture policy as written in the Procedure for Legislation Establishment of the Ministry of Agriculture. This is a top-down process where the Minister designed the medium and long-term development agenda based on the presidential directive. Thus, the Echelon I will be assigned to detail the policy design while the Secretary General will delegate the Echelon II to develop the law and regulation to support the implementation. The non-state agricultural agents, especially farmers and private sectors, are given the opportunity to express their opinion regarding the proposed regulation during the public hearing [19].

This decision-making process suggests that formal rules in governing the drafting of regulation are too government-centric. Arguably, the process should be both top-down and bottom-up approaches. One of the most common instruments to accommodate the grass-root aspiration is by organizing a musrenbang (Development Planning Forum). Musrenbang involves various stakeholders including the village apparatus, community leaders, and marginalized people. The forum can also be held within the regional or national level that is organized by the local government or ministerial level officials. It aims to discuss the community problem, needs, development program, and financial resources that will be prioritized in the following year [20]. The discussion result will be incorporated in the Medium-term Village Development Work Plan that is supported by Village Fund Allocation, Special Allocation Fund, Local Government Budget, Ministerial Budget, and other resources.

4.2. Determining policy options in mainstreaming sustainable use of suboptimal lands
Assessment seeks to inform decision-makers by predicting and evaluating the potential impacts of policy options [21]. Each option has a causal and solution dimension that offers different opportunities for change or also known as change space [22]. The assessment is not intended to be a scientific approach but rather provides a set of critical policy nudges that decision-makers can consider when trying to gauge where to start a reform and what activities that need to be implemented.

This paper adopted change space approach in identifying each option by using triple influencing parameters: a) Authority (political, legal, organizational, and personal support needed for intervention); b) Acceptance (willingness of the affected stakeholders to accept the need for change and its implications); and c) Ability (availability of time, money, and skills to create reform) [22]. Other parameters such as short-term and long-term effectiveness and cost efficiency were also added to estimate the policy feasibility. Each policy option will be classified using Low, Medium, and High based on literature analysis and general field condition. Thus, the policy recommendations will be divided into three categories: High-Priority Policies which imply low cost activity with significant impact, Game-Changing Policies which underline important goals that can be achieved under long-term iterative process, and Supplementary Policies which bring additional improvements but would require formal and non-formal engagement with actors outside the Ministry of Agriculture [23]. The assessment of the proposed policy options is delivered in the following table 2.
Table 2. Assessment of Policy Options

| No | Options                                                                 | Effectiveness | Authority | Acceptance | Ability | Efficiency | Category       |
|----|-------------------------------------------------------------------------|---------------|-----------|------------|---------|------------|----------------|
|    |                                                                         | Short Term    | Long Term |            |         |            |                |
|    | **Policy & Regulations**                                                |               |           |            |         |            |                |
| 1  | Integration of SLM concept and suboptimal land utilization into policy framework | Low           | High      | High       | Medium  | Medium     | High-Priority  |
| 2  | Prioritization of suboptimal lands for Food Estate location             | High          | High      | High       | Medium  | Medium     | High-Priority  |
| 3  | Strengthen grass-root forum to influence the policy-making             | Medium        | High      | Low        | Low     | High       | Game-Changing  |
| 4  | Incent local governments to prioritize rural development               | High          | Low       | Low        | Medium  | Medium     | Supplementary  |
|    | **Investment**                                                          |               |           |            |         |            |                |
| 5  | Higher incentive scheme for farmers that work in suboptimal lands      | High          | High      | Low        | Medium  | Low        | High-Game-Changing |
| 6  | Special Allocation Fund for suboptimal lands agriculture development    | High          | High      | Medium     | Medium  | Medium     | High-Priority  |
| 7  | Budgeting scheme for infrastructure and technology                      | Medium        | High      | Low        | Medium  | Low        | Game-Changing  |
| 8  | Provide market access and investment                                   | Medium        | High      | Medium     | High    | Low        | High-Priority  |
| 9  | Direct Cash Assistance (BLT)                                            | Low           | Medium    | Low        | Medium  | Low        | Game-Changing  |
|    | **Land-use Strategies**                                                |               |           |            |         |            |                |
| 10 | Integrate the suboptimal lands agriculture into the National Spatial Planning Plan | High          | High      | High       | Medium  | High       | High-Priority  |
| 11 | Assess suboptimal land areas and their feasibility for agriculture conversion | High          | High      | High       | Medium  | High       | High-Priority  |
| 12 | Address overlapping land status, permits, and utilization plan.        | High          | High      | Low        | Medium  | Low        | Game-Changing  |
| 13 | Provision of land rights and ownership to farmers with minimum 2 ha or land area | High          | High      | Low        | High    | Low        | Game-Changing  |
|    | **Farmers Development**                                                |               |           |            |         |            |                |
The table above grouped each option into three categories by taking into account the estimated number of regulation changes or effort to convene other stakeholders that need to take place to implement recommended policy option; the overall support from public sector stakeholders and general public; and the estimated additional time and human resources that would need to be mobilized to implement the intervention [22]. Based on the assessment result, we lay out each option into a change space chart that outlined their authority and effectiveness [23]. The first indicates whether the planned action lies under the MoA jurisdiction or required inter-ministerial collaboration and legal change, while the latter suggests whether the policy would drive a positive impact in the short-term but might be ineffective in a long-term or vice versa.

The analysis shown in the figure 2 below where each number represents the policy options number in the previous table.

**Figure 3. Design Space of Policy Options**
Options that are classified as high-priority include integrating suboptimal land agriculture into the existing national development and spatial plan, determining Food Estate location, providing Special Allocation Fund, market and investment, and capacity development for farmers and local institutions. These policies are considered easier to implement since they largely lie under the MoA authority and can bring significant contribution to agriculture development. The required regulations, roadmap plan, and empowerment program already exist to the point the government only needs to incorporate a specific policy related to suboptimal land agriculture.

Meanwhile, the options that fell into the game-changing category are important but would take longer time to execute since they need inter-ministerial collaboration. Enabling the grass-root forum like musrenbang to have a bigger role in policy-making requires a large support from the existing authority and legal change. Fiscal instruments such as incentive scheme, crop insurance, or financing source from Regional Revenue and Expenditure Budget, or Revenue Sharing Fund need strong support and extensive work with the Ministry of Finance and regional government especially in determining the budgeting scheme [24]. Intensive coordination, especially with National Land Agency, National Development Agency, and Ministry of Environment and Forestry are also needed to address overlapping land-use, permits, agrarian reform, and land certificates issuance.

Lastly, the supplementary policies are the ones that most likely only generate medium impact. Giving incentive to the local government could improve their work qualities yet performance-based payments are not cost efficient, especially when both district and provincial level institutions do not provide a meticulous work evaluation system [25]. Medium impact is also prevalent in the direct cash assistance program. A study suggested that it may help farmers maintain stable consumption levels during short-term economic shocks, but future perception and children’s wellbeing perception are not found to be affected [26]. Utilizing a behavioral approach also brings little impact since the farmers may become reluctant to participate in an empowerment program if there is no inducement provided.

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