International Journal of Management and Commerce Innovations ISSN 2348-7585 (Online)
Vol. 11, Issue 2, pp: (314-326), Month: October 2023 - March 2024, Available at: www.researchpublish.com

A Rice Food Sufficiency Index and Sustainable Food Agricultural Land Needs (SFAL) in North Lombok Regency

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DOI: https://doi.org/10.5281/zenodo.10649030

Published Date: 12-February-2024

Abstract: **The transition from agricultural to non-agricultural land has become a national issue in Indonesia. Land conversion has resulted in the reduction of food-productive agricultural land and has had a negative impact on achieving food security. Therefore, the author proposes an initiative to formulate a formulation of a food sufficiency index and minimum food area to achieve food sufficiency for rice and can also be used to achieve sufficiency for other types of food. Using data sourced from the Department of Agriculture and Food Security, the Central Statistics Agency of North Lombok Regency and West Nusa Tenggara Province to determine the status of rice food adequacy and the minimum food area required to achieve food sufficiency. As a result, North Lombok Regency is included in the vulnerable category food rice, except in 2018, including sufficient food rice. The variables determining rice food adequacy are the area of paddy fields h , planting index, rice productivity per hectare, and rice food consumption per person per year.**

Keywords: **Rice Food Sufficiency Index, Department of Agriculture and Food Security, Central Statistics Agency.**

1. INTRODUCTION

Food is a basic human need [1]. As a basic need, food availability must be able to meet the needs of all people in the North Lombok Regency area. Top advantages Community food needs become a source of food reserves in order to support national food independence. Absolute food independence requires the availability of sustainable agricultural land [2], because agricultural land is an asset in agricultural development [3].

Facts show that the potential for agricultural land is experiencing physical and quality decline (degradation) due to land conversion from agricultural to non-agricultural [4]; [5], land fragmentation, shrinkage and pollution of irrigation water which threatens the achievement of sustainable prosperity and food independence. Ironically, the conversion of land from agricultural to non-agricultural uses actually occurs on productive agricultural land that should be protected. Regional governments need to increase awareness of the public and state civil servants that protection of sustainable food agricultural land very important .

Protecting sustainable food agricultural land involves the interests of various parties which are synergistic and contradictory [7]. Contradictions arise due to population growth, increasing people's living standards, improving public services which require land for housing, offices, shops and other physical infrastructure. Alignment of conflicting interests with the protection of sustainable food agricultural land requires regulation in regional regulations as well as following up on the mandate of Law Number 41 of 2009 concerning Protection of Sustainable Food Agricultural Land and Government

Regulation Number 1 of 2011 concerning Determination and Transfer of Functions. Sustainable Food Agricultural Land, as confirmation of the importance of maintaining the availability of agricultural land for food in the long term, as well as regulations relating to the preservation of agricultural land and preventing conversion of agricultural land through careful and wise consideration.

In line with Law Number 41 of 2009 and Government Regulation Number 1 of 2011 above, West Nusa Tenggara Province Regional Regulation Number 1 of 2013 concerning Protection of Sustainable Food Farming Land has also been stipulated which emphasizes the importance of maintaining the standard area for rice fields. in every region , every district/city in West Nusa Tenggara Province [8].

North Lombok Regency as part of the West Nusa Tenggara Province region is obliged to implement statutory regulations without violating other regulations that are interrelated with each other, so that a study is needed regarding rice food adequacy and predictions of the need for sustainable food agricultural land as part of it. from efforts to support food independence.

The rapid development carried out by the Government and Regional Governments, as well as by the private sector, especially development that requires the use of space, will result in the reduction and narrowing of agricultural land, thereby changing its function to housing, industry and trade.

The physical geographical conditions of the North Lombok Regency region, which is mostly dry land farming with undulating topography, have complex problems in efforts to achieve food independence, security and sovereignty. Food agricultural land problems include [9];[10]:

1. Land conversion occurs on productive food agricultural land, because geographical conditions with flat topography have a higher attractiveness than dry land. The expansion of land conversion is increasing rapidly from year to year due to population growth, economic growth, and the development of trade and industry.

2. The awareness of the public and state civil servants regarding the protection of productive food agricultural land still needs to be increased, so that the conversion of productive food agricultural land can be controlled wisely.

3. Bargaining position bid farmer tend to give in when there is *a tug*- of-war between farmers' interests with developer interests in efforts to maintain their agricultural land by releasing their agricultural land with compensation for the increase in the selling value of agricultural land.

4. The relatively low net benefits of agricultural businesses when compared to industrial, trade and service businesses make it difficult to consider the legality of land conversion from agricultural to non-agricultural, so protecting productive food agricultural land is relatively difficult, except through political policies in the agricultural sector. efforts to secure performance. independence, security and food sovereignty.

Fulfilling food needs does not only involve fulfilling physical needs, but also concerns the honor and dignity of the nation as well as the state's obligations in fulfilling the human rights of citizens. This problem is a noble task of the government which must be fulfilled even in difficult situations and conditions by protecting or preserving and developing food agricultural land resources so that they are available sustainably.

The purpose of writing the rice food sufficiency index and the need for sustainable food agricultural land is to examine the analytical aspects of the rice food sufficiency index and the need for sustainable food agricultural land as a basis and material for preparing regional development planning in this context, protecting Sustainable Food Agricultural Land in North Lombok Regency.

2. LITERATURE REVIEW

2.1. Sustainable Food Farming Land Concept

Sustainable Food Agricultural Land is an area of agricultural land designated to be protected and developed consistently to produce staple food for national food independence, resilience and sovereignty; while the definition of Sustainable Food Agricultural Land Protection is a system and process of planning and determining, developing, utilizing and fostering, controlling and supervising food agricultural land and its territory in a sustainable manner.

Protection of Sustainable Food Farming Land is carried out based on Sustainable Food Farming Land planning which is carried out at:

1. Sustainable Food Agriculture Area

Areas in the form of expenditure that have been designated as Sustainable Food Agricultural Land and Sustainable Food Agricultural Reserve Land as well as supporting elements where food agricultural cultivation is carried out which functions to support national food independence, resilience and sovereignty are called Sustainable Food Agriculture.

The implementation of Sustainable Food Agricultural Land Protection is hampered by the lack of proactive attitude of stakeholders *regarding* the transfer of land functions from agricultural to non-agricultural, there are at least 3 (three) fundamental obstacles, namely [9]:

a. policy coordination, because there are no standard regulations that can cover all existing efforts to control and protect productive agricultural land;

b. planning consistency, namely there is still no consistency between regional spatial planning regulations and regional long-term and/or medium-term development plans, as well as other related regulations;

c. coordination of policy implementation, namely differences in interpretation between stakeholders regarding the implementation of laws and regulations , so that changes in officials have implications for variability in decision making and implementation.

2. Sustainable Food Farming Land

What is meant by sustainable food agricultural land is technical, semi-technical, simple and rain-fed irrigated rice fields. Sustainable food agricultural land is productive food agricultural land that can be cultivated with a minimum planting index of 100% to 300%, or can be planted with rice and/or secondary crops at least 1 (one) time in up to three planting seasons in one year. Food agricultural land in the form of rice fields must be protected as part of efforts to achieve food independence, security and sovereignty. Therefore, sustainable food agricultural land must be protected from land conversion which can result in a reduction in the area of rice fields.

This protection is not only for land but also farmers through various forms of programs and coaching activities so that farmers' income and welfare continues to increase, including through the provision of agricultural production facilities (inputs), cultivation technology, harvest and post-harvest, harvest technology, agricultural management, protection price. agricultural products, as well as providing input subsidies and output subsidies .

3. Sustainable Food Agriculture Reserve Land

Reserve land for sustainable food agriculture can be abandoned land, land overgrown with weeds/shrubs, former forests, swamps, peat, fields, moors, and/or damaged/unproductive gardens.

Taking into account the condition of the vegetation in the North Lombok Regency area, the reserve land for sustainable food agriculture is abandoned land (idle land), land overgrown with weeds/shrubs, damaged/unproductive gardens, as well as ex-mining excavated land. Meanwhile, productive plantation land such as land planted with cloves, coffee, cocoa and coconut is difficult to use as reserve land for sustainable food agriculture, because farmers' income from plantation crops is more competitive than food crops.

2.2 Sustainable Food Agricultural Land Protection Strategy

1. Control of Land Function Transfer

Heriyanto[13] stated that the objectives of the issuance of Law Number 41 of 2009 concerning Protection of Sustainable Food Agricultural Land include, among other things, protecting food agricultural areas and land in a sustainable manner and ensuring the availability of land in the long term with the aim of realizing noble ideals, namely independence, resilience, and food sovereignty , as well as community welfare.

A strategic effort to protect sustainable food agricultural land and control productive land conversion is to provide legal certainty over productive food agricultural land through the issuance of regional regulations. Regional Regulations that regulate zones and areas of sustainable food agricultural land in rural areas, provide reserves of sustainable food agricultural land, create food agricultural land to replace the conversion of agricultural land to non-agricultural land, guarantee access

of farming communities to productive agricultural land by providing supporting facilities [9], and provide clear and firm sanctions to perpetrators who violate Regional Regulations.

The preparation of Regional Regulations needs to involve all stakeholders, including farming communities who are members of farmer groups and/or combinations of farmer groups, farmer associations, traditional community leaders, religious leaders, and officials responsible for maintaining sustainable food farming land, as well as obtaining approval from Regional People's Representative Council (CRPR).

2. Agricultural Area Management Regulations

Agricultural areas are areas in rural areas which are agricultural cultivation areas consisting of food crop farming, horticulture, plantations, animal husbandry and fisheries, while sustainable food farming areas are agricultural areas and are part of cultivation area. The regulation of cultivation areas is outlined in regional regulations regarding Regency Regional Spatial Planning (RRSP) and explicitly states the location of sustainable food agricultural land and sustainable food agricultural reserve land.

3. Replacement Food Agricultural Land Printing

In principle, sustainable food agricultural land is defined as part of a cultivation area that is specifically used as a location for cultivating food crops (rice and secondary crops). Sustainable Food Agricultural Land (SFAL) is technically irrigated , semi-technical irrigated, simply irrigated and rain-fed rice fields that are protected from land conversion. In principle, SFAL cannot be converted, unless it is truly necessary for the public interest by establishing strict land conversion requirements. Every area of agricultural food land undergoing conversion must be given a replacement before conversion of agricultural land to non-agricultural land in sustainable food agricultural reserve areas with a certain area multiple. Replacement of food agricultural land must be at least 3 (three) times the area of wetland agricultural land through the creation of new rice fields in sustainable food agricultural reserve areas where infrastructure and irrigation facilities have been prepared.

4. Guarantee Farmers' Access to Productive Agricultural Land

Farmers' access to productive agricultural land is closely related to land ownership status. Farmers who own land have the best access to food agricultural land when compared with the status of sharecroppers (farmers, cultivators, gade, or farm laborers).

Therefore, farmer ownership of productive agricultural land is an urgent matter to be regulated in the Regional Regulation on Protection of Sustainable Food Agricultural Land [14], meaning that farmer owners who wish to relinquish ownership of their agricultural land, the regional government can provide a wise solution, so that Ownership of rice fields does not change ownership to developers or investors which could hinder farmers' access to productive agricultural land. One way out is to buy land owned by farmers and hand over its management to farmers who have rental or sakap status, then rent out or share the results obtained from the land to become a source of Regional Original Income (ROI).

Farmers' access to productive agricultural land, apart from the social aspect, also comes from the physical aspect, namely the provision of agricultural road infrastructure connected to public roads. The availability of infrastructure and means of transportation is a determining factor in a farming location's access to markets.

What is no less important is agricultural land's access to water sources connected through irrigation networks. Therefore, productive food agricultural land must be connected to technical, semi-technical or simple irrigation networks.

3. METHODOLOGY

3.1 Data Collection Methods

Data was collected from primary sources and secondary sources [16]. Data from primary sources was collected using observation techniques and in-depth interviews [17] with village officials in selected villages in each sub-district. The selected villages are West Selamat Village and East Istrian Village in Selamat District, Sokong Village and Tanjung Village in Tanjung District, Bentek Village and Gondang Village in Gangga District, Kayangan Village and Santong Village in Kayangan District, Akar-akar Village and Village Parrot in Bayan District. Secondary data was collected using desktop study techniques (18), namely reviewing references and annual reports from regional apparatus organizations, including from the Agriculture and Food Security Service, Regional Development Planning Agency, North Lombok Regency Central Statistics Agency, Central Statistics Agency West Nusa Tenggara Province , and the Central Statistics Agency of the Republic of Indonesia.

3.2 Data Processing and Analysis Methods

Primary data and secondary data were processed using descriptive statistical methods [19]. Data is processed using computer equipment using Microsoft Office applications, then the data is displayed in simple table format, cross tables, flow charts, pictures and narratives.

The Rice Food Sufficiency Index (RFSI) is measured using the following formula:

$$RFSI = \frac{Produksi\ Beras}{Kebutuhan\ Beras} = \text{R ice Production (ton)/R ice Needs (ton)}$$

Conclusions Drawn:

If RFIS > 1 region is sufficient food rice

If RFSI < 1 k alert rice food insecurity

Next, to predict the need for sustainable food agricultural land, an analysis is carried out with the formula:

$$L = \frac{P\ x\ B}{V\ x\ CI}$$

Information:

L = minimum land area required for sustainable food agriculture (ha)

P = Population (people)

B = Rice Consumption (tons/person/year)

V = Rice Productivity (tons/ha)

CI = Planting intensity

4. RESULTS ANALYSIS

4.1 Soil and Land Conservation

The soil type in North Lombok Regency is dominated by *sandy loam* with a low level of soil fertility (marginal soil), because the soil is porous, low in organic matter (<1.0%) and also poor in macro nutrients. The relatively acidic chemical nature of soil (pH 5.0 – 6.2) causes a low content of available nutrients [20]. Based on the results of field observations, the soil pH in the rice fields of Santong village ranges from 5.0 – 5.5; while the soil pH in rice fields in Anyar village ranges from 6.3 – 6.5.

In connection with soil conditions that are low in organic matter content and poor in macronutrients, it is very necessary to improve the physical and chemical properties of the soil through the addition of organic matter, application of organic fertilizer, as well as soil and land conservation. , and avoid burning vegetation, but the biomass obtained is converted into compost, then used as organic fertilizer. Soil with low acidity requires the application of lime so that the soil pH increases to approach neutral pH, namely 6.5 – 7.0 [21].

Most of the land in North Lombok Regency is dry land, not rice fields, mainly in the form of fields, gardens and forests. The land used for rice fields covers an area of 9,654 ha (Table 3), the largest being in Bayan District, namely 4,042 ha. Others are land used as residential areas and infrastructure with an area of around 30,774 ha. Availability of dry land in the form of abandoned land, former forests, unproductive fields and gardens as potential food reserves. Food reserve land can be used as replacement food land due to the conversion of rice fields to non-agricultural land.

The existing rice fields are technical irrigated rice fields, semi-technical irrigated rice fields, simple irrigated rice fields (village irrigation), and rain-fed rice fields. Technically irrigated rice fields are found in Bayan District, Kayangan District, Gangga District, and Tanjung District. Among the irrigated rice fields in North Lombok Regency, the irrigated rice fields located in Tanjung District are class 1 rice fields that can be planted with rice three times a year [8], but are vulnerable to conversion. land, because the Tanjung District area is an urban area that is developing as a city for government, trade and services. In the future, rice fields in the Tanjung District area, especially those located on either side of the main road, will be converted into offices, urban areas and residential areas; Meanwhile, rice fields in Kayangan District are relatively small and there is potential for land conversion as an area for tourism, trade and services development.

Rice fields that have changed their function from productive agricultural land to non-agricultural land must be replaced outside Tanjung District and outside Kayangan District through efforts to open new rice fields whose area is 3 (three) times the area of the converted rice fields. The replacement locations are in Gangga District, Kayangan District, and Bayan District.

4.2 Mitigation, Adaptation and Overcoming the Consequences of Climate Change

North Lombok Regency is an area with a tropical climate with air temperatures ranging from 22.10 ºC – 32.80 ºC.

As a tropical area, the North Lombok Regency area is suitable for growing rice and secondary crops (corn, peanuts, cassava, sweet potatoes) throughout the year in the rainy planting season (from November to February) and the dry growing season (from March to June) and the 2nd dry season (July to October).

Air humidity ranges from 75% - 85%. Maximum air humidity occurs in December at 85%, while minimum humidity occurs in September at 75%. Rice plants can be cultivated in three seasons throughout the year on technically irrigated rice fields, two planting seasons on semi-technical irrigation (RS and DS-1), while upland rice is planted on upland fields. during the rainy season (RS) planting season.

The average intensity of solar radiation is 72%. Maximum illumination occurs in August, namely 91%, while minimum illumination occurs in December at 24%. High light intensity, and supported by irrigation infrastructure and sufficient water availability as well as the application of cultivation technology (use of superior hybrid seeds, balanced complete fertilizer, row legowo planting system, and agricultural mechanization) enable the productivity of food crops, especially in the lowlands, to achieve harvests. dry grain above 6 tonnes/ha.

The average wind speed is 17 knots, the maximum speed occurs in November, namely 23 knots, while the minimum speed occurs in June and July, namely 12 knots. The average air pressure is 1,011.68 mbs which is characterized by two seasons, namely the dry season and the rainy season. Air pressure ranges from 1,008.5 mbs – 1,012.1 mbs. Climate type D in the western region and type E in the eastern region with wet months between 5 – 6 months.

The development of rainfall (Table 1) shows that the amount of rainfall ranges from 1,072 mm to 1,905 mm/year. The lowest rainfall occurred in 2019 and the highest in 2021. The average rainfall was 1,637.8/year. Total rainfall > 100 mm/month for 6 months, namely in November, December, January, February, March and April; while the amount of rainfall < 100 mm is 6 months, namely May, June, July, August, September and October. The types of plants cultivated are adapted to rainfall conditions. Suitable for planting from November to April, while secondary crops and horticultural crops are suitable for planting from May to October each year. However, care needs to be taken in determining plant types because of the risk of climate change, so farmers need to anticipate the climate change cycle between El Niño and La Niña.

Table 1. Amount of Rainfall by Month in Gangga District, North Lombok Regency, 2017-2021

Month year	2017	2018	2019	2020	2021	Average
January	260	445	434	352	150	328.2
February	308	335	81	552	458	346.8
Line up	207	195	371	337	312	284.4
April	310	124	28	93	81	127.2
Possible	152	0	12	126	10	60.0
June	58	77	0	92	99	65.2
July	0	0	0	0	0	0
August	0	0	0	13	21	6,8
September	0	0	0	101	167	53.6
October	42	0	2	42	90	35.2
November	120	102	73	135	217	129.4
December	332	82	71	220	300	201.0
Amount	1,789	1,360	1,072	2,063	1,905	1,637.8

Source: Central Statistics Agency, 2022.

The rainfall pattern as shown in Table 1 takes place from October to April, but there are changes in rainfall patterns which tend to be shorter with almost the same amount of rainfall each year. The tendency for high rainfall intensity in a short period of time is called climate change .

The development of precipitation (Table 1) is confirmed by the number of rainy days. The average number of rainy days is 102 days/year. The average number of rainy days > 10 days occurs from November to April the following year, while the average number of rainy days less than 10 days lasts for six months from May to October (Table 2). The lowest number of rainy days occurred in 2018, while the highest occurred in 2019. The least rainfall and the highest number of rainy days occurred in 2019, meaning that in 2019 there was frequent rain with low rainfall.

Table 2. Number of Rainy Days by Month in Gangga District, North Lombok Regency, 2017-2021

Month year	2017	2018	2019	2020	2021	Average
January	5	17	25	11	16	14.8
February	8	9	22	15	17	14.2
Line up	10	8	26	15	14	14.6
April	13	10	20	9	9	12.2
Possible	5	0	10	7	2	4.8
June	6	1	0	1	6	2.8
July	0	0	4	2	0	1.2
August	0	0	0	1	6	1.4
September	0	0	1	9	12	4.4
October	7	0	5	3	8	4.6
November	13	5	19	8	19	12.8
December	14	3	27	14	15	14.6
Amount	81	53	159	95	124	102.4

Source: Central Statistics Agency, 2022.

The symptoms of "La Nina" are an increase in rainfall and the number of rainy days compared to normal climate conditions. The "La Nina" phenomenon arises due to low sea surface temperatures in the Pacific Ocean and warm sea surface temperatures in the Indian Ocean. Symptoms of “la nina” recur periodically every 6 – 7 years. The "la nina" phenomenon occurred in 2010 and occurred again in 2016. The "la nina" phenomenon caused rice production to increase, while the production of plantation products and annual crops tended to decrease. Usually the rainy season comes around the beginning of September and lasts until July the following year, while the dry season is relatively short.

The opposite condition occurs in the "El Nino" phenomenon, namely that rainfall and the number of rainy days are relatively small compared to normal conditions. The rainy season arrives at the end of November or early December and ends in February or March of the following year. The symptoms of "El Nino" are called a long dry season. The climate with the symptoms of "El Nino" causes many agricultural lands to experience drought, the available surface water is not enough to grow rice plants normally, there is drought on agricultural land, especially on simply irrigated and rain-fed rice fields. Rice production has decreased compared to normal climate conditions.

In connection with climate change and climate symptoms as described above, mitigation, adaptation and disaster management strategies are needed, as well as floods, erosion , landslides , and all the impacts it causes. Natural disasters due to climate change can cause damage to food crops and decrease agricultural production.

Mitigation is an effort to prevent, control and avoid global warming as the main cause of climate change, while adaptation is an effort to adjust to the impacts of climate change that occur through adjusting behavior and using technology. Mitigation focuses on efforts to prevent climate change by reducing, avoiding and eliminating sources of carbon gas , as well as increasing absorption, thereby reducing carbon gas emissions. which contributes to climate change. Giving awards to parties who contribute to reducing carbon gas emissions, as well as providing sanctions to parties who release carbon gas into the air is a positive policy, so it is very good to be used as material for the Regional Regulation on the Protection of Sustainable Food Agriculture.

Adaptation to climate change is an effort to accept the reality that occurs through changes in behavior, substitution and elimination of technology, including the use of varieties that are resistant to climate change, changes in cultivation and irrigation techniques, regulation of seasons and planting distances, and so on. Farmers' ability to adapt and mitigate climate change is called smart farming.

4.3 Irrigation Network Infrastructure and Maintenance

It is the government's obligation to build and maintain irrigation network infrastructure and facilities in an effort to achieve and maintain food self-sufficiency. These obligations include restoring water sources in upstream areas by preserving forests, harvesting and storing water sources, distributing water from sources to planting plots.

The construction and maintenance of irrigation infrastructure in the form of dams, reservoirs and primary, secondary and tertiary irrigation networks is the task of the central and regional governments as well as the participation of the community, traditional leaders and youth leaders as part of agricultural development and improving community welfare. Limited water resources can be utilized optimally by reducing the volume of water wasted into the sea. Water (*hydro)* resources are rotated and directed to agricultural areas through the construction of canals and water tunnels so that they can reach wider agricultural areas, as well as building multi-level irrigation systems.

The undulating and hilly topography of the North Lombok Regency area is both a challenge and an opportunity in distributing available water resources. Barriers in the form of valleys, canyons or hills result in a lot of potential water being wasted into the sea during the rainy season. Water wasted into the sea can be minimized by building dams or water reservoirs (*dew)* for use in the dry season, as well as expanding the irrigation network area.

The area of rice fields tends to decrease despite efforts to open new rice fields, due to land conversion from agricultural land to non-agricultural land. The development of land conversion is greater than the area of new rice fields. The area of non-irrigated rice fields increased due to the creation of non-irrigated rice fields in Gangga District, Kayangan District and Bayan District. The area of non-irrigated rice fields in 2018 almost doubled compared to 2016, while from 2019 to 2021, the creation of new rice fields was temporarily stopped, due to the Covid-19 pandemic.

Table 3. Area of Irrigated and Non-Irrigated Rice Fields in North Lombok Regency 2016-2018

Subdistrict	Irrigation			Non Irrigation			Amount		
\Year	2016	2017	2018	2016	2017	2018	2016	2017	2018
Winner	400	400	400	17	17	5	417	417	405
Cape	683	703	683	8	8	8	691	711	691
Ganga	1235	1238	1235	0	38	0	1235	1276	1235
Kite	2549	2549	2549	350	696	732	2899	3245	3281
Parrot	3305	3283	3305	371	399	737	3676	3682	4042
North Lombok	8172	8173	8172	746	1158	1482	8918	9331	9654

Source: North Lombok Regency Public Works, Waterworks, Housing and Energy Department

To expand the reach of irrigation networks, integrated planning between river areas is needed, including building a network of water channels between rivers. Geographical obstacles and obstacles were overcome by building canals, tunnels and closed irrigation networks.

Water use must be effective and efficient, and prevent pollution. Placing water directly to plant roots through a drip irrigation system and/or watering plants directly into planting plots will make water use efficient, so that limited amounts of water can be utilized in a wider agricultural area.

4.4 Geographic Conditions

The North Lombok Regency region is the result of the expansion of the West Lombok Regency area which is located to the north of Mount Punikan, Mount Sangkareang and Mount Rinjani . B over the North Lombok Regency area to the north: Java Sea, to the south: West Lombok and Central Lombok . to the east: East Lombok Regency, and to the west: Lombok Strait.

The area of North Lombok Regency is 1,312.77 km ^{2} .It consists of a land area of 809.53 km ^{2} (61.67%) and an ocean area of 503.24 km ^{2} (38.33%). There are 5 (five) sub-district areas, 33 villages and 322 hamlets. The sub-districts are Kayangan, Tanjung, Gangga, Kayangan and Bayan sub-districts.

1. Topography

The topography of North Lombok Regency is hilly and mountainous stretching across the northern part of Lombok Island from east to west with the peak of Mount Rinjani (3,775 m above sea level). North Lombok Regency is located at 116 ° 1' 31.99" - 116 ° 29' 35.76" East Longitude and 8 ° 12' 37.44 – 8 ° 28' 49.58 South Latitude.

Based on regional altitude, most of North Lombok Regency is at an altitude of 500 – 1000 meters above sea level (mpl) with an area of 689,507 ha (52.36%) of the area of North Lombok Regency, 100 – 500 meters with an area of 28,331 ha , and 0 – 100 meters high with an area of 19,363 ha (1.47%). This shows that most of the North Lombok Regency area is in the middle plains and highlands. Topographic conditions like this are suitable for the growth of food crops, horticulture and plantations.

The level of slope of land in North Lombok Regency varies greatly and is classified into 4 (four) slope classes with details: slope level 0 – 2%; 2 - 15%; 15 - 40%; and >40%.

The slope of the land is a factor that really needs to be considered in all development activities, especially physical development. This is because the slope of the land affects erosion. The longer and greater the slope of the land, the faster the surface flow and the carrying capacity of the flow.

A suitable location for food crops is land with a slope of less than 8%, while land with a slope of more than 8% is suitable for planting annual crops (plantations).

2. Vegetation

The vegetation in the North Lombok Regency area as reported by [22], mahogany (*Switenia m acrophylla),* klokos shrimp , mending, suango, cempaka, rajumas, calliandra, suren, durian, odang, walnuts, bajur, sengon (*Pharaseriantes falcataria),* etc. The government and the community are obliged to protect plants in forest areas and outside forest areas which are river watersheds as part of efforts to preserve water sources which are very necessary for the continuity of food crop production and meeting various water needs for the community.

The plantation area is dominated by cloves, durian (*Durio zibethinus)* , gaharu (*Aquilaria malaccensis)* , gamal (*Gliricidia s epium),* cocoa (*Theobroma cacao* L.) , coffee (*Coffea r obusta)* , cashew nut (*Anacardium occidentale),* pulai (*Alstonia)* . *Scholar)* ; avocado (*Persea a jasana);* mango (*Mangifera indica),* mitaq, jackfruit (*Artocarpus heterophyllus),* kapok (*Ceiba pentandra),* and coconut (*Cocos nusifera*) . Among these plants, most are sources of fresh and processed food.

Food and horticultural crop farming areas are dominated by rice, corn, peanuts, cassava, sweet potatoes, peas (*lab-lab*), pigeon peas, long beans, chilies, tomatoes, eggplants, cucumbers, watermelons, bananas, etc. . Food and horticultural crops are cultivated in rice fields, moors and gardens.

3. The area of rice fields and non-rice fields

Protected areas include: protected forest areas including customary forests, areas that provide protection to the area below them; local protected areas; nature reserve areas, natural conservation and cultural heritage areas, areas prone to natural disasters; geological protected areas; and other protected areas.

Cultivation areas include: designated production forest areas; agricultural designated areas; fisheries designated area; mining designated areas; industrial designated areas; tourism designated areas; residential area; areas designated by the government; areas designated for trade and services; and other designated areas.

Agricultural areas include: food crop cultivation areas, horticultural cultivation areas, plantation areas, including: cocoa in Selelos and Santong, vanilla in Selelos and Santong, coffee, cashew nuts; and livestock areas include large farms, including beef cattle and horses, small farms, including goats and pigs.

Agricultural cultivation in rice fields in the rainy season is rice cultivation and in the dry season secondary crops such as peanuts, cassava and corn. Agriculture cultivated on non-rice fields consists of plantation crops such as coconut, cocoa, coffee, cloves and cashew nuts. Four of the five types of plantation crops are leading commodities in North Lombok Regency, namely coconut, cocoa, coffee and cloves, while many cashew plantations are damaged and have not been rejuvenated. This former cashew plantation has the potential to be used as a location for sustainable food reserves, apart from abandoned land, land overgrown with weeds/shrubs and former C-excavated mines (pumice, sand, landfill) and former forest land.

4.5 Rice Production

Rice is produced from rice that has been peeled. The separated rice husks are called husks, while the rice seeds which contain starch and protein and other compounds are called rice. The yield from rice to rice ranges from 62% to 66%. The average yield of rice into rice is 64%.

Table 4. Rice production in North Lombok Regency 2018 – 2022.

Variable	2018	2019	2020	2021	2022
Harvested area (ha)	5,843	4,567	4,720	5,341	5,674
Productivity (tons/ha)	4,987	5,950	5,698	5,670	5,655
Rice Production (tons)	18,650	13,549	17,213	19,381	20,535

Source: Converted from data from the NTB Central Statistics Agency

4.6 Projections of Population and Rice Food Needs

The population of North Lombok Regency continues to increase at a growth rate of 2.08%/year. In 2010, the population was recorded at 200,072 people, increasing to 247,400 people in 2020. The population development from 2018 to 2022 and the amount of rice consumption can be seen in Table 5.

The population of North Lombok Regency is the Sasak tribe and a small number of other tribes such as Balinese, Mbojo, Samawa, Javanese, and others.

Spatially, the population of North Lombok Regency is spread across five sub-districts. Bayan District has the largest population compared to other districts. The population in Bayan District in 2021 reached 55,018 people, relatively not much different from that in Tanjung District, namely 5,5,130 people. The sub-district with a relatively small population is Kayangan District, namely only 50,517 people, the other sub-districts are Gangga and Kayangan Districts, with 52,238 people and 48,548 people respectively.

Table 5. Number of Population and Rice Food Needs of North Lombok Regency Population 2018 - 2022

Variable	2018	2019	2020	2021	2022
Population (people)*	218,533	220,412	247,400	251,451	256,438
Rice Consumption (tons/person)**	0.08090	0.07843	0.07849	0.08183	0.08135
Rice Requirements (tons/year)	17,678	17,287	19,418	20,576	20,862

Source: *North Lombok Regency Central Statistics Agency for 2019 to 2023

**Converted from Central Statistics Agency data

The fairly high increase in population is one of the population problems. From 2010 to 2020 the population growth rate in North Lombok Regency reached 2.08%, higher than the period from 2000 to 2010 of 1.44 percent. The highest population growth rate was in Kayangan District at 2.39%. The high population growth in Kayangan Regency is caused by increasing birth rates and migration from outside the district.

Based on the data in Table 4 and Table 5, the Rice Food Sufficiency Index can be calculated (Table 6). The Rice Food Sufficiency Index (IKPB) is calculated from the comparison of rice production to rice requirements. The research results show that in 2018 IKPB > 1 means that rice production was able to meet the rice food consumption needs of the population, and was in the sufficient rice food category.

Table 6. Rice Food Sufficiency Index for North Lombok Regency 2018 - 2022

Variable	2018	2019	2020	2021	2022
Rice Production (tons)*	18,650	13,549	17,213	19,381	20,535
Rice Requirements (tons)**	17,678	17,287	19,418	20,576	20,862
Rice Food Sufficiency Index	1 , 05493	0.78377	0.88649	0.94195	0.98432

Source: Processed from data from the Central Statistics Agency West Nusa Tenggara Province* and National BPS**.

If rice production is converted into rice with a conversion rate of 0.64, rice production in 2018 will be 18,650 tons, while in 2022 with a population of 256,438 people will need around 20,535 tons of rice.

In the emergence of production data, overestimation often occurs, especially due to observations using plotting and multiplication methods using rice field area and harvested area. In fact, the accuracy of this data is questionable, because during the harvest season, rice prices remain high, as an indication of excess demand over supply (*over demand)* , while the stocks visible in warehouses are not visible, except in farmers' warehouses. barn.

The survey results for rice consumption in September 2022 were 6.81/kg/person/month, while the survey results in March 2022 recorded rice consumption at 6.66 kg/person/month [23]. Meanwhile [24] reported that per capita rice consumption was quite high, namely 114.6 kg per person per year. Even though the price of rice has increased, rice consumption is still high. The Food Agency Price Panel shows that the price of medium rice in 2022 will be IDR 11,880 per kg, while in 2021 it will be IDR 10,700 per kg. This price is the national average at the retail trader level in July. Likewise, the average national price of premium rice at retail level is IDR 13,590 per kg, even though in July 2022 it will still be IDR 12,250 per kg. The difference in rice price data in the two survey results is due to the unstable price of rice and continuing to change from month to month.

Table 7. Need for paddy fields for rice crops in North Lombok Regency 2018-2022

Variable	2018	2019	2020	2021	2022
Population (people)	218,533	220,412	247,400	251,451	256,438
Rice Consumption (tons/person/year)	0.0809	0.0784	0.0785	0.0818	0.0814
Crop Index (%)	0.61	0.47	0.63	0.83	0.91
Rice productivity (tons/ha)	3.1917	3.8080	3.6467	3.6288	3.6192
Crop Area Requirements (ha)	9,152	9,626	8,506	6,841	6,319
Rice Field Area (ha)	9,654	9,684	7,540	6,444	6,221

Source: North Lombok in Figures 2019, 2020, 2021, 2022 and 2023

The distribution of rice fields in North Lombok Regency based on the type of irrigation can be detailed as follows:

a. Rain-fed and simple irrigation fields cover an area of 454 ha or 6.36% of the total area of rice fields, with one rice planting a year.

b. Technically irrigated rice fields have an area of 8,172 ha or 84.65% of the rice field area. Technically irrigated rice fields are rice fields that receive irrigation or technical irrigation, namely an irrigation network whose irrigation channels are separated from drainage channels so that the provision and distribution of irrigation can be measured and easily regulated. Usually this kind of network consists of primary and secondary channels and the buildings are built and maintained by the Irrigation Service/Government. Technically irrigated land can be planted with rice twice a year.

c. Semi-technical irrigated rice fields covering an area of 1,339 ha or 13.87% of the rice field area. Semi-technical irrigated rice fields are rice fields that receive irrigation from semi-technical irrigation which is the same as technical irrigation, but in this case the Irrigation Service/Government only controls the tapping structures to be able to regulate water withdrawals while the subsequent network is not measured and not controlled by the Irrigation Service/Government.

d. Simple irrigated rice fields covering an area of 9 ha (0.1% of the total area of rice fields. Simple irrigated rice fields are rice fields that receive water from irrigation where the water distribution system is not yet organized even though the Government has participated in building part of the network.

The area of technical and semi-technical irrigated rice fields is 6,676 ha (Table 3). Of the rice fields, some have been and will be converted into non-agricultural land. Data on the area of rice fields as in Table 4 and Table 5 above is believed to have not been corrected to the actual conditions, because the data has barely decreased even though there has been a conversion of rice fields into residential areas, shops and stores. office area.

Based on observations via *Google Earth*, *Google Map* and *Ground Check* (Field Survey) in 2016 showed that the rice fields that have the potential to be protected as Food Agricultural Land (LPP) cover an area of 5,531 ha spread across 5 (five) sub-districts while the land is in abandoned land, land overgrown with weeds/shrubs , moors, gardens and other things that have the potential to become Agricultural Food Reserve Land (LCPP) covering an area of 9,669 ha spread over 4 (four) sub-districts (Table 6), while the rest is used as Non-Agricultural Food Land (LBPP).

5. CONCLUSION

The amount of rice production is less than the amount of rice food requirements with a rice food sufficiency index of less than 1 (one), so that North Lombok Regency is included in the rice food insecurity category, but in 2018 it was still classified in the rice food sufficient category . To maintain food security conditions for rice, a minimum food area of 6,319 ha is required with a planting index of 91% and rice productivity of 3.62 tonnes/ha.

The variables determining rice food sufficiency are standard rice field area, irrigated rice field area, planting index, rice productivity per hectare, and per capita rice consumption per year. Therefore, to meet rice food needs, these determining variables need to be increased significantly through agricultural intensification and development of agricultural sector infrastructure, only rice consumption needs to be diversified with other food sources.

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