

Mapping Potential Sustainable Food Crop Land in North Bontang District to Support Food Security

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Abstrak

Penelitian ini bertujuan untuk memetakan potensi lahan pertanian pangan berkelanjutan di Kecamatan Bontang Utara guna mendukung ketahanan pangan di wilayah perkotaan. Penelitian menggunakan metode deskriptif-komparatif dengan pendekatan berbasis spasial melalui analisis peta Rencana Tata Ruang Wilayah (RTRW) Kota Bontang Tahun 2023–2042 dan citra satelit Google My Maps. Data yang digunakan berupa data sekunder meliputi peta RTRW, citra satelit, dan data administrasi wilayah dalam format SHP. Analisis dilakukan dengan membandingkan pola ruang pada RTRW dengan kondisi aktual penggunaan lahan untuk mengidentifikasi area yang berpotensi dikembangkan sebagai lahan pertanian pangan berkelanjutan. Hasil penelitian menunjukkan bahwa Kecamatan Bontang Utara memiliki potensi lahan pertanian yang terbatas dan tersebar tidak merata akibat dominasi kawasan industri, permukiman, dan aktivitas ekonomi perkotaan. Konversi lahan menjadi kawasan terbangun menyebabkan berkurangnya ruang pertanian dan meningkatnya ketergantungan terhadap pasokan pangan dari luar daerah. Namun demikian, beberapa area seperti lahan kosong, pekarangan rumah, dan ruang terbuka masih memiliki potensi untuk dikembangkan melalui konsep urban farming. Pengembangan pertanian perkotaan menjadi alternatif strategis dalam meningkatkan ketersediaan pangan lokal dan mendukung ketahanan pangan masyarakat. Faktor fisik, spasial, dan ekonomi menjadi aspek utama yang memengaruhi kesesuaian lahan sehingga diperlukan pengelolaan lahan yang berkelanjutan serta dukungan pemerintah dan masyarakat dalam optimalisasi pemanfaatan ruang pertanian di kawasan perkotaan.

Kata kunci: Ketahanan pangan, Lahan pertanian berkelanjutan, Urban farming

Abstract

This study aims to map the potential for sustainable food agriculture land in North Bontang District to support food security in urban areas. The study uses a descriptive-comparative method with a spatial-based approach through analysis of the 2023–2042 Bontang City Spatial Plan (RTRW) map and Google My Maps satellite imagery. The data used are secondary data including the RTRW map, satellite imagery, and regional administration data in SHP format. The analysis was conducted by comparing the spatial patterns in the RTRW with actual land use conditions to identify areas with the potential to be developed as sustainable food agriculture land. The results show that North Bontang District has limited agricultural land potential and is unevenly distributed due to the dominance of industrial areas, settlements, and urban economic activities. Land conversion into built-up areas has resulted in reduced agricultural space and increased dependence on food supplies from outside the region. However, several areas such as vacant land, home yards, and open spaces still have the potential to be developed through the concept of urban farming. The development of urban agriculture is a strategic alternative in increasing local food availability and supporting community food security. Physical, spatial, and economic factors are the main aspects that influence land suitability, so sustainable land management and government and community support are needed in optimizing the use of agricultural space in urban areas.

Keywords: Food security, Sustainable agricultural land, Urban farming

INTRODUCTION

Development in the agricultural sector has significant strategic potential, especially for maintaining food security and driving regional economies. The agricultural sector not only meets the community's food needs but also provides a livelihood for most of the population, especially in rural areas. With increasing population and food demand, the pressure on agricultural land is growing, so agricultural land management must be optimized sustainably. Accurate and spatial-based information on agricultural land potential becomes very important. Such information can be used in planning and policymaking, especially for suitability and land carrying capacity in food production. Spatial approaches, such as the utilization of Geographic Information Systems (GIS), can provide a more comprehensive overview of land conditions (Nurfadhilah *et al.*, 2026).

Bontang City is geographically located between 117°23' and 117°34' East Longitude and 0°01' and 0°12' North Latitude. Bontang City is one of the industrial cities in East Kalimantan Province, covering an area of 16,188 hectares (Mashudi *et al.*, 2024). Of the total area of Bontang City, 70% of the city's area will be used for housing, industry, offices, economic centers, and businesses (Nandiasa *et al.*, 2020; Oktaviansyah *et al.*, 2025). According to data from the Central Statistics Agency (2023); the Food and Agriculture Organization (FAO), Bontang City is known as a region with an economic structure dominated by the industrial sector, particularly the energy processing industry, resulting in limited land availability for agricultural activities and a decline in local food production capacity. Therefore, regional food security becomes increasingly dependent on distribution from other regions.

The phenomenon of increasingly rapid urbanization has created a need for more efficient, sustainable agricultural systems based on the utilization of local resources. Urban farming has become a rapidly growing adaptive solution to address various challenges in food security, waste management, and environmental sustainability in urban areas (Widiarta *et al.*, 2025). Urban farming is a form of agriculture that utilizes backyards, vacant land, or other neglected spaces. Urban farming is a modern form of agriculture that typically grows specific and practical crops (Amanda *et al.*, 2023).

Food security is a strategic issue in global development because it is directly related to various multidimensional challenges, ranging from environmental, social, and economic aspects (Syakirotni *et al.*, 2023; Tito and Triyasari (2026) Disruptions to the food supply chain due to the global crisis and other external factors have also worsened public access

to food, especially for vulnerable groups (Ernawati, *et al*, 2024). This situation demonstrates unequal access to food, necessitating integrated and sustainable efforts to strengthen the food system to make it more resilient in the face of these various global pressures (Cahyono *et al.*, 2024).

North Bontang District, part of the urban area of Bontang City, plays a strategic role as an economic and industrial center, characterized by the dominance of land use for industrial areas, residential areas, and commercial activities. This situation indirectly drives high spatial intensity, creating significant pressure on the availability of Green Open Space (GOS), which serves as an ecological balance in urban areas. Rapidly expanding urban activities, such as industry, transportation, and residential areas, contribute to land use dynamics and increase the need for space, but also limit the availability of adequate open space. This is evident in the failure to meet standards for the proportion of GOS in Bontang City, which remains below the ideal requirement, as well as the problem of land constraints due to urban and industrial development pressures (Meidiana *et al.*, 2024). Research shows that the ever-expanding urban area places significant pressure on the availability of green open space through massive land-use changes. In addition, the designation of industrial areas also influences changes in land use, which is characterized by a reduction in agricultural land due to conversion into built-up areas.

MATERIAL AND METHOD

This research used a descriptive-comparative method with a spatial-based approach. The descriptive method aims to describe land use conditions in the study area, while the comparative method analyzes land use comparisons between the RTRW map and actual conditions observed through satellite imagery. The spatial-based approach is used to detect differences in land use between the spatial plan and the reality on the ground.

This research was conducted in North Bontang District. All data used in the study were secondary. These secondary data included the RTRW map of North Bontang Regency for 2023–2042, satellite imagery obtained through Google My Maps, and administrative data from North Bontang District in SHP format. The RTRW map serves to explain spatial use patterns and land use determination in accordance with the existing spatial plan, while satellite imagery was used to observe the actual condition of land use at the study site.

The analysis process involved comparing the spatial patterns shown on the RTRW map with the actual land use conditions seen in the satellite imagery. Next, areas showing potential for agricultural land were identified, particularly agricultural land zones with the

potential to become sustainable agricultural areas. The results of this analysis were then described in detail to provide an overview of the agricultural land use found at the study site.

RESULTS & DISCUSSION

Based on the spatial analysis of the 2023–2042 Bontang City Spatial Plan (RTRW) map and Google My Maps satellite imagery, it is known that North Bontang District has relatively limited and unevenly distributed agricultural land potential. This condition is influenced by the dominance of land use for industrial areas, residential areas, commerce, and other rapidly growing economic activities in urban areas. Most of the land in North Bontang District has undergone land use conversion into built-up areas, resulting in a decline in agricultural land.

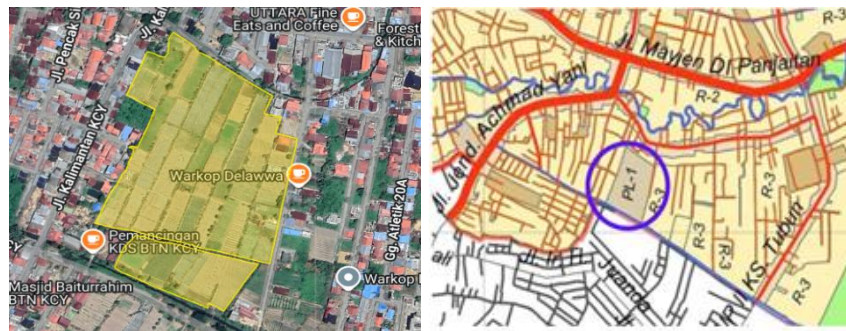


Image 1. Agricultural land location

The distribution of agricultural land potential in North Bontang District exhibits a unique characteristic compared to other agrarian regions in general, as land availability tends to be limited and unevenly distributed. This is influenced by the dominance of land use for industrial, residential, and other economic activities, which continues to expand. Consequently, space for agriculture is becoming increasingly limited. Nevertheless, several areas still have potential for development, particularly vacant land, home yards, and underutilized open spaces. This potential distribution pattern tends to be sporadic and is more common in areas with low building density. The approach to agricultural development in North Bontang cannot rely solely on conventional systems; instead, it needs to be directed toward small-scale land use and urban agriculture concepts to continue supporting food security amidst limited space (Wahyudi *et al.*, 2023).

Factors influencing land suitability in North Bontang District are not solely viewed from a single perspective, but are the result and combination of several important interrelated factors. Climate conditions, soil type, and topography are key determinants

because they directly relate to the land's ability to support plant growth. Rainfall, soil fertility, and slope significantly determine whether a plot of land is suitable for agriculture. Spatial factors also play a significant role, particularly in terms of accessibility and existing land use. Land that is easily accessible and does not conflict with other land uses is more likely to be developed. Furthermore, economic factors cannot be ignored, particularly pressure from industrial activity and high land values in urban areas such as North Bontang. These conditions often prioritize land for industrial or residential purposes over agricultural use, indirectly affecting the suitability and opportunities for agricultural land development in the region (Alfi *et al.*, 2025; Nugroho *et al.*, 2026)

The availability of agricultural land in North Bontang District is quite limited, primarily due to the limited availability of rice paddies and the dominance of industrial activity in most of the area. This pattern of land use further limits agricultural space, thus reducing opportunities for local food production. Consequently, existing agricultural output is unable to optimally meet the needs of the local community. This situation demonstrates that North Bontang is more industrially oriented than agriculturally, making dependence on food supplies from outside the region difficult to avoid (Paselle *et al.*, 2019)

Urban farming in North Bontang District offers significant potential as a solution to meeting the food needs of urban communities. This can be achieved through the use of home gardens, the management of unproductive vacant land, and the development of agriculture at the household and community level. Urban farming is an important alternative amidst limited agricultural land due to the development of industrial and residential areas. In addition to increasing local food availability, this activity also supports community food self-sufficiency and creates a more productive environment. However, its implementation still faces several obstacles, such as limited public knowledge regarding cultivation techniques, limited use of agricultural technology, and suboptimal support from government and corporate CSR programs (Andika, 2024).

SUGGESTION AND CONCLUSION

North Bontang District has limited agricultural land potential due to the dominance of industrial and residential areas. However, the utilization of vacant land, home yards, and open spaces still offers potential for development through the concept of urban farming to support community food security. Agricultural development is influenced by physical, spatial, and economic factors, requiring sustainable land management and government and community support to optimize urban agriculture.

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