



The Rural Urban Linkages in Fulfilling Vegetable Food Consumption in the City of Yogyakarta

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Abstract. The fulfillment of food needs in urban areas will not be separated from the surrounding hinterland areas as a unit. Sometimes, the hinterland of an urban area is very extensive and not borderless in administrative areas. This study aims to analyze the potential ability of an urban area, namely the city of Yogyakarta, to meet its vegetable food needs. In addition, the potential areas for surrounding rural areas (Bantul, Sleman, Kulon Progo, and Gunungkidul) to contribute to meeting the vegetable food needs in the city of Yogyakarta because so far, vegetable food needs are mostly fulfilled from agricultural areas in Central Java (Magelang, Temanggung, Wonosobo, Boyolali, and surrounding areas). National Socio-Economic Survey household consumption data is used to determine household consumption levels for urban communities, while production data are sourced from horticultural statistics in Special Region of Yogyakarta. The results show that urban farming in Yogyakarta City only consists of four types of commodities with limited production, while production in the districts of Special Region of Yogyakarta has a relatively large amount of production. However, the production has not been able to meet the needs of the city of Yogyakarta. This condition is indicated by the entry of vegetable commodities from outside Special Region of Yogyakarta. Fulfilling the need for vegetable food in each region is one of the causes of the need for vegetable food in the city of Yogyakarta is still met from outside the district. In addition to household needs, the needs of sectors in the city are one of the causes of the high demand for vegetable food commodities.

Keywords: Rural urban linkages · Vegetable consumption · Vegetable production · Vegetable commodity

1 Introduction

Urban areas have complex functions with high population numbers and density [1]. The complexity of urban areas is characterized by various economic activities in the area which is growing rapidly into a center of population concentration that continues to grow physically, socially, and economically forming its characteristics [2]. The high economic activity attracts residents to move from rural areas to cities (urbanization) which increases the function of land Urban areas for the trade sector and various business scales have

increased due to the high demand for supporting the life of the housing community which is more consumptive [3]. Land conversion also occurs in suburban areas due to urban development. This condition also occurs on the outskirts of the urban area of Yogyakarta [4–7]. In addition, urbanization has changed people's consumption patterns which inflicted in high demand [8–10].

The increase in population in urban areas increases the number of buildings for residential residents so that urban areas are increasingly dense [11]. This phenomenon occurs globally where more than half of the world's population lives in urban areas [12], even the number of people living in urban areas is expected to increase to 66% of the world's population by 2050 [13].

The high population in urban areas will have an impact on the use of natural resources and the environment by the population to meet the primary needs of life, namely food, which, if uncontrolled, will result in a decrease in the quality and quantity of natural resources and the environment. Natural resources and the environment are dynamic, both in quantity and quality, and changes in natural resources and the environment are transitional from being dominated by nature, to then dominated by humans [14]. The high population in urban areas increases the need for food, while the availability of natural resources for food fulfillment is limited.

Food availability is highly dependent on natural conditions, which increase the complexity of the food system. The flow of food commodities is an important component of the food system to ensure food availability which is closely related to high food demand and seasonal variations in production flows [15]. Thus, urban areas that are increasingly densely populated will increase the conversion of food production land into settlements while food needs are increasing. This condition encourages the fulfillment of food needs from outside urban areas or rural areas around urban areas.

Food security in a complex way includes food availability, smooth distribution, price stabilization, and maintaining the purchasing power of farmers, which the government must strive to ensure that every population gets it evenly [16]. Limited food resources greatly affect the pattern of resilience and household strategies [17]. Household resilience is the level of ability of rural households to maintain the continuity of meeting consumption needs and the continuity of the production process [18].

The urban area is understood as an area that is interconnected with the surrounding suburbs. Rural-urban interactions are of concern with urban metabolism. The periphery or hinterland becomes an area that supports urban areas by supplying various agricultural products, while the city becomes a service center area that requires various agricultural products. Both complement each other so that it is a unit that is also interconnected with other regions and cities.

The city of Yogyakarta is the location of the center of regional activities, which is a growth pole. This urban area has a high population. Limited agricultural land makes this area need food supplies from the surrounding agricultural areas. Previous research [19] explained that food needs that enter Yogyakarta are supplied from agricultural areas in Central Java, such as Magelang, Wonosobo, Temanggung, and surrounding areas. This condition shows a relationship between the two regions. The city of Yogyakarta is a hub as well as a location with great demand. Agricultural areas in Central Java are supply locations that produce various horticultural agricultural products.

So far, most of the vegetable (horticultural) food in the city of Yogyakarta has been met from outside Special Region of Yogyakarta. The difference in the characteristics of the region and the commodity sector developed is one of the causes of commodities from outside entering Yogyakarta. This also indicates that the hinterland of Yogyakarta City is spacious and unlimited to the administrative area. The great demand in Yogyakarta, supported by the existence of the main market as a hub, as well as an adequate road and transportation network, has been able to transport various commodities from the Central Java region to the city of Yogyakarta. The hinterland areas around Special Region Yogyakarta, such as Sleman, Kulon Progo, Bantul, and Gunungkidul also produce vegetable food commodities (horticulture). This study aims to explain how the potential of vegetable food production in fulfilling household vegetable demand in the city of Yogyakarta. The types of vegetable commodities and their quantities will show how the existing production can meet the food needs in urban areas.

2 Methods

This study is located in the city of Yogyakarta, the center of regional activities, as well as urban areas in Special Region of Yogyakarta (Fig. 1). High population with the existence of the service trade sector. The tourism and education sectors generate high demand for food, one of which is vegetable food commodities. The fulfilment of food availability in the city of Yogyakarta has been supported by other areas outside Special Region of Yogyakarta so far. The calculation of food production in the city of Yogyakarta, and the surrounding area as the nearest hinterland, namely Sleman, Bantul, Kulon Progo, and Gunungkidul, is carried out to see how far production can meet the needs of the nearby urban area.

The data used in this study are sourced from Statistics Indonesia. To analyze urban vegetable food needs, Statistics Indonesia micro-survey data for 2021, namely the National Socio-Economic Survey, is used. This data shows the amount of food consumption in a household sample in one week. The number of household samples taken in the National Socio-Economic Survey in Yogyakarta City is 722. Commodity consumption data used are 15 vegetable commodities. The data used to analyze food availability are horticultural commodity statistics in 2021 which are also provided by Statistics Indonesia for each research area.

The average household vegetable consumption in the city of Yogyakarta and the average vegetable production in and around the city of Yogyakarta for household-scale fulfillment is calculated using the formula below.

The Average of Household Vegetable Consumption (kg/week) =

$$\frac{\text{Vegetable consumption by purchase (kg/week)}}{\text{Number of household}} \quad (1)$$

The Average of Vegetable Production in and around Yogyakarta City to fulfill household scale in Yogyakarta City (kg/week) =

$$\frac{\text{Vegetable production in and around Yogyakarta City (kg/week)}}{\text{Number of household in Yogyakarta City}} \quad (2)$$

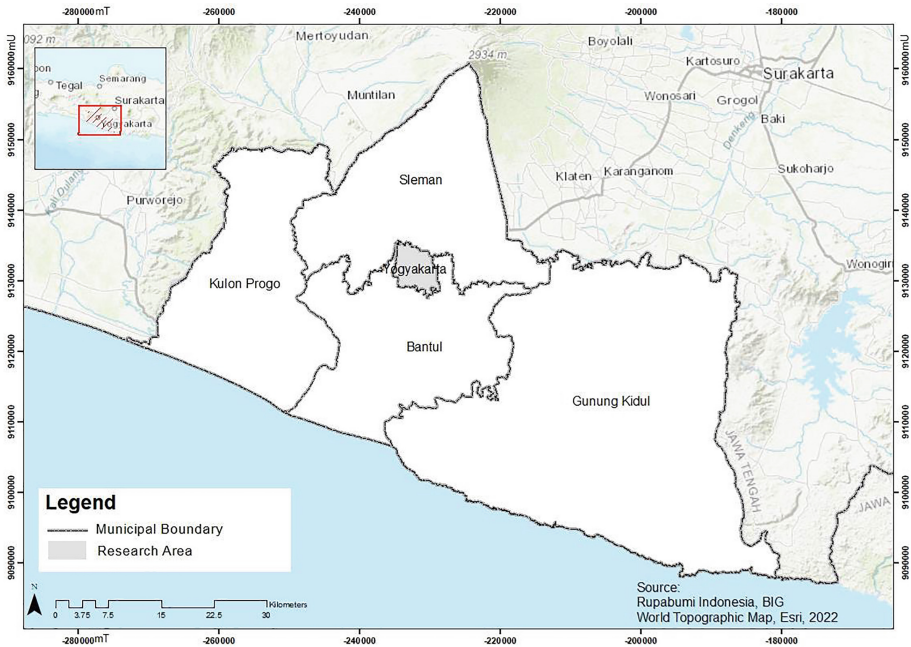


Fig. 1. Research Location

The calculation results are presented in a table and processed into a map to show information spatially to support spatial analysis. Data analysis was done using descriptive analysis techniques by presenting consumption and production data using the table, radar diagram, and map.

3 Results and Discussion

The number of foods and drinks that are consumed by a person or group to meet their nutritional needs is called food consumption [20]. The government seeks to realize a healthy food consumption pattern in which every household ideally consumes nutritious, diverse, healthy, and safe food [21]. The body needs vitamins and minerals as nutrients to support healthy life, which can be obtained from vegetables and fruits [22]. World Health Organization (WHO) recommends the consumption of vegetables and fruits for a healthy life amounting to 400 g per person per day. To be able to explain how the supply and demand for vegetable food in the city of Yogyakarta, various data on household vegetable consumption patterns are needed. Calculation of the amount of vegetable consumption per household in the city of Yogyakarta needs to be identified based on the data.

3.1 Vegetable Food Consumption Pattern in Yogyakarta City

Consumption patterns between urban and rural communities will be different. This condition is strongly influenced by the region's characteristics, occupation, and consumption

behavior. Vegetable consumption patterns can indicate the type and quantity of household commodities at a specific time.

3.1.1 Vegetable Commodities Consumed by Households

Various vegetable commodities are consumed by the population, which in this study was assessed per household in the city of Yogyakarta. Based on the data obtained, it was found that households in the city of Yogyakarta consumed vegetable commodities in the form of spinach, water spinach, cabbage, napa cabbage, beans, yardlong beans, tomatoes, carrots, cucumbers, eggplants, chayotes, shallot, garlic, red chili, and cayenne pepper (Table 1). This commodity category is based on the National Socio-Economic Survey by Statistics Indonesia data category. These commodities are the types of commodities consumed by households in one week.

3.1.2 The Pattern of Consumption of Vegetable Food in the Household

Various vegetable commodities are consumed by the Each vegetable commodity consumed per household in the city of Yogyakarta has variations in consumption patterns. The average vegetable consumption per household in the city of Yogyakarta is between the lowest average consumption of 0,12 kg/week, namely red chili and cayenne pepper, to the highest average consumption of 0,69 kg/week, namely water spinach (Table 1). Vegetable food consumption shows the average food consumption needs per vegetable commodity per household per week in the city of Yogyakarta.

3.2 Vegetable Food Production in Yogyakarta City

Vegetable food production in the City of Yogyakarta is expected to meet the demand for vegetable consumption. The level of soil fertility, availability of land, priority of land use and expertise in vegetable cultivation are the keys to have high levels of vegetable production in an area. However, it cannot be denied that some vegetable commodities cannot be cultivated easily but require special conditions.

3.2.1 The Existing Condition of Vegetable Food Production

As an urban area, the city of Yogyakarta does not have a large-scale agricultural sector. The city of Yogyakarta is more focused on the secondary sector in the form of services and trade. Seeing the huge potential for food demand, it is very alluring if the supply of vegetable food is seen from the side of the urban area itself, even though most horticultural commodities are undeveloped in the city of Yogyakarta. The concept of Urban Farming has been developed in the form of a vegetable village and community activities on a small scale. However, the scale of production of these agricultural activities is still unable to contribute more to meet the vegetable food needs of Yogyakarta City.

The need for vegetable food per household in the city of Yogyakarta needs to be balanced by the availability of vegetable food in the city of Yogyakarta. Based on the data obtained, many vegetable commodities in the city of Yogyakarta have an average production of 0 kg/week or are unavailable at all, whereas the city of Yogyakarta only

Table 1. The average of household vegetable consumption per commodity in Yogyakarta City

No.	Vegetable Commodity	The average of household vegetable consumption (Kg/week) in Yogyakarta City
1	Spinach	0,50
2	Water spinach	0,69
3	Cabbage	0,39
4	Napa Cabbage	0,46
5	Beans	0,33
6	Yardlong beans	0,32
7	Tomatoes	0,26
8	Carrot	0,35
9	Cucumber	0,46
10	Eggplant	0,60
11	Chayote	0,51
12	Shallot	0,19
13	Garlic	0,18
14	Red chili	0,12
15	Cayenne pepper	0,12

Source: Statistics Indonesia, 2021

has an average production of napa cabbage, tomatoes, eggplant, and cayenne pepper (Table 2). This condition is supported by [23] which states that napa cabbage cultivation is convenient where napa cabbage can be planted throughout the year, can live in various places both in the highlands and in the lowlands, is resistant to various kinds of weather as long as watering is carried out regularly so that it still enables production potential in urban areas. In contrast, tomatoes, which are plants with a short life cycle but can be planted in polybags in the yard, have aesthetic value and are very suitable for consumption to meet the nutritional needs of family members. In addition, the prospect of eggplant cultivation is also getting better to be managed intensively and commercially on an agribusiness scale, because the demand for eggplant is very high but can still be grown fertile in the yard in polybags. Meanwhile, local cayenne pepper planted in polybags and planted in garden plots did not show an extreme difference in production, making it suitable for cultivation in the yard, which supports the data that cayenne pepper is produced in the city of Yogyakarta. This statement strengthens the choice of napa cabbage, tomatoes, eggplant, and cayenne pepper as vegetable commodities that can be produced in the city of Yogyakarta. However, the availability of vegetable food produced in the city of Yogyakarta is still very limited because more vegetable commodities are unavailable.

Table 2. The average of vegetable production to fulfill household scale per commodity in Yogyakarta City

No.	Vegetable Commodity	The average of vegetable production to fulfill household scale (Kg/week) in Yogyakarta
1	Spinach	0,00
2	Water spinach	0,00
3	Cabbage	0,00
4	Napa Cabbage	0,30
5	Beans	0,00
6	Yardlong beans	0,00
7	Tomatoes	0,06
8	Carrot	0,00
9	Cucumber	0,00
10	Eggplant	0,20
11	Chayote	0,00
12	Shallot	0,00
13	Garlic	0,00
14	Red chili	0,00
15	Cayenne pepper	0,05

Source: Statistics Indonesia, 2021

3.2.2 Fulfillment of Vegetable Food Production to the Needs of Vegetable Food Consumption

The lack of vegetable food commodities produced in the city of Yogyakarta shows the lack of fulfillment of vegetable food production to meet the needs of vegetable food. Many vegetable food commodities whose consumption needs are not met by production, and even vegetable commodities produced in the city of Yogyakarta, namely napa cabbage, tomatoes, eggplant, and cayenne pepper also do not meet the needs of the average household consumption in the city of Yogyakarta (Fig. 2). This is related to the high population density in the city of Yogyakarta, which causes an increase in settlements which reduces open land for vegetable production. In addition, a high population causes the need for housing to be higher while land prices tend to rise so that housing land in urban areas tends to become increasingly narrow, which limits the opportunities for productive yards [24]. This condition is very hapless because the land around the house has the potential to be developed into a yard. The yard is a plot of land around a house building which is usually limited by a fence or wall with private ownership status [25]. The concept of the yard, can be called an ecosystem service because it focuses on maintaining the balance of the ecosystem that can provide ecosystem services to its users [26]. The availability of home yard land in urban areas is expected to support the fulfillment of family food to support the national food security program [24]. Vegetable food

production should be able to meet the needs of the average vegetable food consumption in the city of Yogyakarta, but what happened was just the opposite of Yogyakarta needed to meet the needs of vegetable food from other surrounding areas.

3.3 Rural Urban Linkages in Special Region of Yogyakarta in the Context of Meeting Food Needs

The city of Yogyakarta is surrounded by rural areas which act as hinterlands. Within the scope of the unique region of Yogyakarta, the area consists of the regencies of Sleman, Bantul, Kulon Progo, and Gunungkidul. Each of these hinterland areas has its characteristics, especially the commodities that can be produced. Rural-urban linkages must be connected to meeting food needs in urban areas. For example, the great demand for vegetable food in the city of Yogyakarta must be met from more than just the surrounding hinterland areas. Commodities with certain types and quantities must be imported from hinterland areas outside the Special Region of Yogyakarta.

3.3.1 Vegetable Food Flow

The inability of the City of Yogyakarta to meet the availability of vegetable food through regional vegetable production, causes the demand for vegetable food to be fulfilled from the production of other surrounding areas in order to be able to meet the needs of vegetable food consumption. This research then focuses on studies at the Giwangan Main Market in Yogyakarta as one of the vegetable supply centers in the city of Yogyakarta. Through interviews with vegetable traders at the Giwangan Main Market, the information was obtained on the areas that provide vegetables sold in the market. Based on the results of interviews, it is known that many vegetables are sold at the Giwangan Main Market, which acts as the majority of vegetable providers in the city of Yogyakarta, selling vegetables that are produced from outside the region and even outside the Special Region of Yogyakarta.

Of the 15 commodities selected in this study, 13 vegetable commodities were supplied from areas outside the Special Region of Yogyakarta, while the other 2 commodities were supplied locally in the Special Region of Yogyakarta. In addition, there are 4 commodities produced in the city of Yogyakarta, but the amount is less than the consumption needs of vegetable food commodities, so that these 4 commodities are also included in the 13 commodities which are met from other regions.

The potential for vegetable food production in regencies around Yogyakarta City as a hinterland, which includes Kulon Progo Regency, Bantul Regency, Gunungkidul Regency, and Sleman Regency, is quite potential to meet the needs of vegetable food consumption in Yogyakarta City. The average vegetable production per household in the districts around Yogyakarta City is much higher than the average household vegetable production in Yogyakarta City (Table 3). However, the production is used primarily to meet household vegetable consumption needs in their respective districts. Vegetable needs in an area apart from household consumption are also needed in the tourism sector (hotels and restaurants), education, and other sectors so that production in the regencies around the city of Yogyakarta, which has considerable potential, is only sufficient to

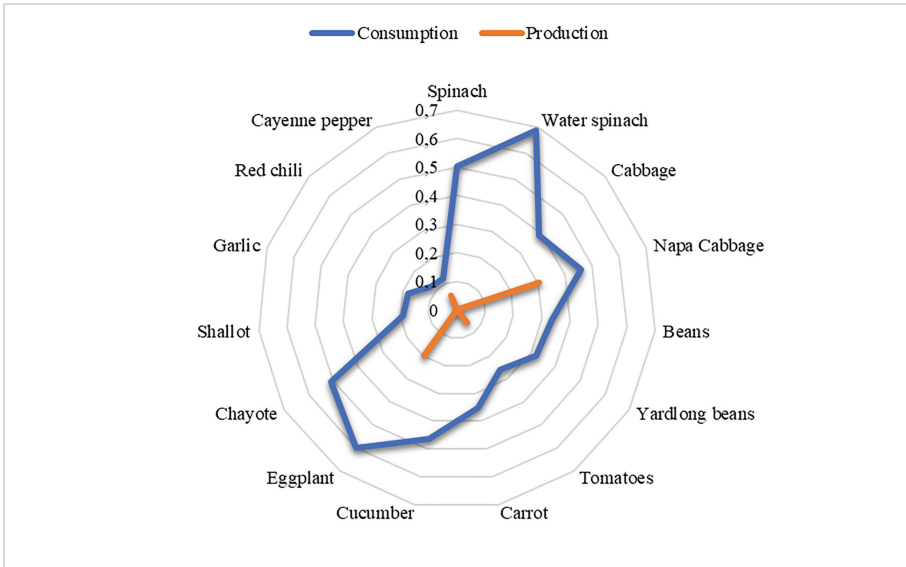


Fig. 2. Radar Diagram Average household vegetable consumption and production per commodity in Yogyakarta City

meet local needs. This is evidenced by the fulfillment of vegetable needs in the city of Yogyakarta, which is met by regencies outside the Special Region of Yogyakarta.

Two vegetable commodities are fulfilled locally in the Special Region of Yogyakarta, namely spinach and water spinach. Based on previous research by [23], explained that spinach has short roots and is easy to plant, so spinach is very suitable to be cultivated in polybags with a verticulture system in very narrow yards. Almost similarly, water spinach as a vegetable plant that is grown as food is suitable for cultivation in the yard, both in polybags and in garden plots, because it is easy and useful for family consumption. The utilization of yards for agriculture or horticulture in urban areas has great potential and provides many benefits, especially for households [27]. Sleman, Kulon Progo, Bantul, and Gunungkidul regencies are on the outskirts of Yogyakarta. Thus, commodities of spinach and water spinach are very easy to produce in the yard of the house, even though there is minimal land, such as in Yogyakarta City and the surrounding districts in Special Region of Yogyakarta, they are still able to produce locally, there is no need to fulfill them from outside Special Region of Yogyakarta.

Meanwhile, the 4 vegetable commodities produced in the city of Yogyakarta are insufficient, so they need to be supplied from areas outside the Special Region of Yogyakarta, namely napa cabbage, tomatoes, eggplant, and cayenne pepper. Regions outside the province that provide vegetable commodities to the city of Yogyakarta, in this case, the Giwangan Main Market, are from Kejajar District, Ngablak District, Dukun District, Kaliangkrik District, Muntilan District, Selo District, Getasan District, and Parakan District. The direction of the flow of vegetable food supply from sub-districts outside the Special Region of Yogyakarta to the City of Yogyakarta based on the number of types of vegetable commodities is mapped in Fig. 3. Kejajar District

Table 3. The average of vegetable production around Yogyakarta City to fulfill household scale per commodity in Yogyakarta City

No.	Vegetable Commodity	The average of vegetable production to fulfill household scale (Kg/week) around Yogyakarta City			
		Kulon Progo	Bantul	Gunungkidul	Sleman
1	Spinach	46,96	14,74	6,53	67,64
2	Water spinach	207,62	79,84	10,56	163,12
3	Cabbage	0,00	0,00	0,12	0,00
4	Napa Cabbage	284,48	41,80	10,44	234,32
5	Beans	17,81	0,00	0,02	15,60
6	Yardlong beans	145,82	16,46	2,27	26,05
7	Tomatoes	50,44	1,02	3,76	36,75
8	Carrot	0,00	0,00	0,00	0,00
9	Cucumber	37,46	101,10	15,83	197,12
10	Eggplant	160,85	8,18	20,21	55,55
11	Chayote	7,80	0,00	0,00	3,06
12	Shallot	423,62	658,21	70,25	8,84
13	Garlic	0,03	0,00	0,00	0,00
14	Red chili	1692,21	140,58	13,67	258,84
15	Cayenne pepper	349,91	214,00	17,53	282,68

Source: Statistics Indonesia, 2021

provides vegetables to Yogyakarta City at most, namely 10 vegetable commodities, which include cabbage, napa cabbage, beans, tomatoes, carrots, cucumbers, eggplants, chayotes, shallot, and garlic. Furthermore, Ngablak District also provides 8 commodities of vegetables, namely cabbage, napa cabbage, beans, tomatoes, carrots, cucumbers, eggplants, and chayotes.

Kaliangkrik District, Muntilan District, and Dukun District each provide 7 vegetable commodities. Kaliangkrik District provides cabbage, beans, eggplant, shallots, garlic, red chilies, and cayenne pepper commodities. The next district, Muntilan provides cabbage, beans, yardlong beans, tomatoes, cucumbers, eggplants, and chayotes. Meanwhile, Dukun District provides napa cabbage, beans, yardlong beans, tomatoes, cucumbers, eggplants, and chayotes. In addition, Selo District also provides quite a lot of 5 vegetable commodities, including cabbage, napa cabbage, beans, tomatoes, and carrots. There is also Getasan District which provides 3 vegetable commodities, including cabbage, tomato, and chayote, and Parakan District which provides 2 vegetable commodities, including cabbage and napa cabbage. The flow of fulfilling the need for vegetable food in the City of Yogyakarta, which originates from the sub-districts around the Special Region of Yogyakarta, shows the linkage of rural and urban in fulfilling vegetable food consumption in the City of Yogyakarta.

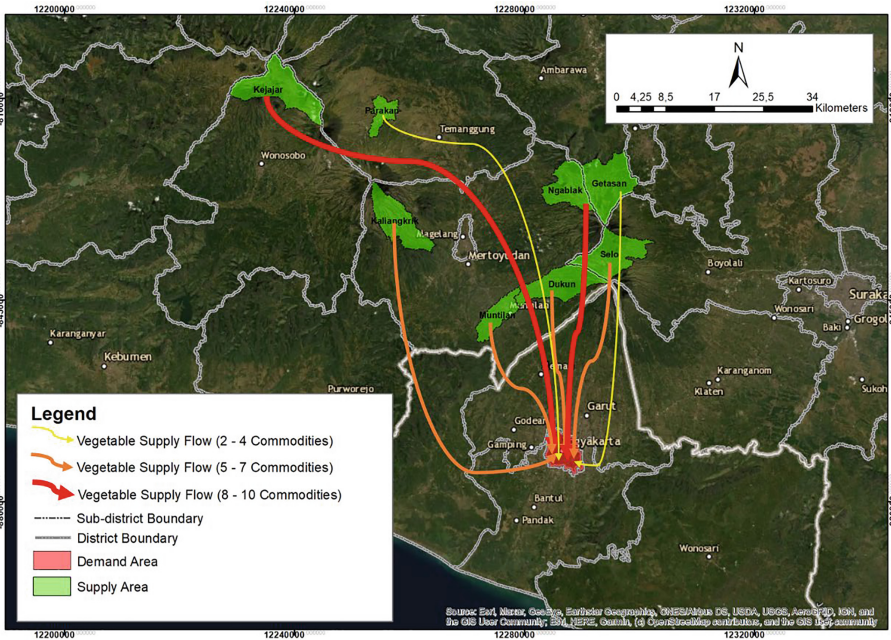


Fig. 3. Vegetable Commodity Flow Map

The large demand for vegetable food in the city of Yogyakarta, both from a household scale and a business or industrial scale must be met by the surrounding hinterland areas, even covering some areas in Central Java. In terms of meeting food needs, there are fundamental differences between urban and rural communities. In times of crisis, urban communities will be very vulnerable to access to food [28]. The increase in food prices is one of the impacts caused by the crisis. At this time, urban communities will have difficulty buying or accessing food. In contrast, to rural communities, most of whom work in the primary sector. The results of food production that are produced can be subsynthetically consumed by themselves. This difference is the basis of food security for rural and urban communities. Aspects of rural and urban linkages should be given special attention to look at the fulfillment and demand for food in urban areas [29].

4 Conclusion

The urban area and its hinterland are an inseparable unit. The two areas are a unified system that interacts and complements each other. The link between the rural and urban is the key to meeting food needs in the city of Yogyakarta. The high demand for vegetable food needs in the city of Yogyakarta cannot be filled alone, both the city of Yogyakarta itself and the surrounding rural areas (Bantul, Sleman, Kulon Progo, and Gunungkidul), so the need for vegetable food must be filled by rural areas or agriculture in parts of Central Java areas such as Magelang, Temanggung, Wonosobo, Boyolali, and surrounding areas. Characteristics of the hinterland region in Special Region of Yogyakarta does not

have the same ability to produce vegetable food commodities as in the hinterland region of Central Java, besides that the low production scale makes production inefficient when transported to Yogyakarta City. There is a lot of potential that emerge from this rural-urban linkage. In addition to benefiting each other, more attention needs to be paid to the potential crisis in urban areas due to rising food prices. In addition, the potential for a waste generation that arises due to food loss and food waste is a distinctive problem in urban areas.

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