POTENTIAL MAPPING AGRICULTURAL COMMODITIES
TO MITIGATION OF FOOD PROBLEM IN THE FUTURE

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Abstract: Catastrophic climate changes that have a negative impact in various fields including agriculture. The research objective is "Potential Mapping Agricultural Commodities to Mitigation of Food Problem in the Future". The research method is quantitative and qualitative. Methods of data collection using field research and literature. The population and the sample is a land unit and village units. Land units determine the suitability of land. The village unit collects socio economic data. The analysis technique used Location Question, Shift Share, Focus Group Discussion and spatial analysis. Spatial analysis using Arc GIS. The findings can be used to mitigate future food problems and analyze policies. The results showed rice plants has S1 class (Very Suitable). Corn, chili, orange and banana land suitability S2 (Suitable), onion is S3 (Marginal Suitable). Priority 1 rice commodity in Ayuang Village. Priority 2 Corn in Banua Binjai. Priority 3 that Chilli in the village of Awang Besar. Results LQ corn and chili have bases sector, other sectors have the non-base. Shift-share value is negative (-) except Chili. FGD results show developed commodity rice, corn, and chili. The development of leading sectors followed by marketing and processing can increase revenue. Limitations of the research do not examine pests that have the potential to cause crop failure.

Key words: mapping, agricultural, mitigation.

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INTRODUCTION

Climate change is a strategic issue and a serious problem in the world, including in Indonesia. Climate change can cause disasters that have a negative impact on food production (Tao and Zhang, 2010; Apriyana, 2011; Las et al., 2011; Mustangin, 2017). The negative impact of long-term climate change to humans and the environment can cause disasters such as extreme droughts, declining yields and food crisis (D'Arrigo et al., 2006; Behera et al., 2008; Hansen et al., 2011; Cullis et al., 2019; Naim and Hindmarsh, 2019).

Fluctuations in the availability of food is influenced climate variations and weather (Apriyana, 2011). Extreme weather represents one evidence of dangerous climate change and is a signal of future climate change (Haden et al., 2012; Renn, 2011; Spence et al., 2011; Linden, 2014a; Mcdonald et al., 2015; Demski et al., 2017). Extreme weather can affect the production and productivity of agriculture. The decline in production and productivity can be minimized by planting a variety of plant species. Knowing the potential of a region can cope with crop failures in the region with good harvests in other regions with different commodities.

Mapping the potential in agriculture, especially food crops and the determination of the growing season is an important strategy to do (Naylor et al., 2007; Yayan et a.l, 2017). The impact of changes in rainfall patterns and seasonal changes cause changes in planting dates (Apriyana and Siburian, 2014). The changes have affected the productivity and food security in each region. Seeing this, it is necessary to map the potential and mitigation of climate change, especially in agriculture. Mapping potential to knowing areas of potential and prospective development, so the government more easily take a strategic development policy. Potential identification can be used to anticipate the product over a particular commodity. Identification of Potential in this case is the identification Potential Land Suitability. Identification of Potential Land Suitability to determine the most suitable land for to be developed in agriculture (Kumalawati et al., 2017). Land Suitability Assessment can be carried out with the parameter of multiplication, addition, or using minimum laws. The minimum law is the match between land quality and land characteristics as parameters with land suitability class criteria based on the growing requirements of the evaluated crop or commodity, such as in agriculture (Zulkarnain and Hartanto, 2020).

Many regions have the potential in agriculture but the land suitability of spatial data is not yet available. Land suitability spatial data is necessary because it can be used to select alternative land management so as to create a stable food security and sustainable. Problems with data availability are also experienced in Hulu Sungai Tengah Regency, resulting in inaccurate planning, utilization and development. Overcoming the problem of the availability of spatial data in agriculture can use Geographic Information Systems. Geographic Information System is a combination of database management in collecting and storing geospatial data function describes the relationship of data in the form of maps (Nyerges, 2009). Geographic Information System provides identification information Potential Land Suitability agriculture. Results Identification used as database in the Agricultural Sector Policy Analysis leading commodities include rice, corn, chili, red onions, bananas and oranges. Local development of superior commodities one attempt to compete in trade and improving the local economy (Rosalina et al., 2017; Wahyuningsih et al., 2014). Agriculture development of is needed to improve the quality of agricultural production, income and standard of living people in an area (Luvianita et a.l, 2017; Mensah and Ekwamu, 2020).

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The agriculture sector has a significant role in the survival of humanity. The problem of food due to climate change is a global problem, including in the area of research. Predictions of future climate change will occur as a result of the food crisis. The food crisis is an important issue so it is necessary to mitigate and map the suitability of land potential in agriculture. The aim of this research "Potential Mapping Agricultural Commodities to Mitigation of Food Problem in the Future"

MATERIALS AND METHODS

Study area

Climate change is a strategic issue in developed countries and developing countries. Climate change has adverse effects on long-term agricultural field (Tao and Zhang, 2010; Las et al., 2011; Mustangin, 2017). Agriculture is an activity of processing plants and the environment in order to provide food and non-food products (Soetriono 2006; Sriyanto, 2010). The basic information needed for the development of agriculture is land resource potential of spatial data (BPPP, 2010). Information on the distribution, size, degree of land suitability, the limiting factor, and alternative technologies that can be applied. Land Suitability Assessment can be done by multiplication parameters, summation, or use the minimum law. The minimum law is matching between Land Quality and Land Characteristics as parameters of Land suitability based on plant growth requirements (Djaenudin et al., 2003; Zulkarnain and Hartanto, 2020).

In fact, the information is not yet available land resources as a whole on a sufficient scale. In addition, cooperation between the public, private sector and the government has not been established. Society, and the private sector are government actors at national, regional or local level (Meijerink and Dicke, 2008; Mees et al., 2013). Good cooperation for the collection of spatial data is needed to mitigate climate change especially in agriculture (Termeer et a.l, 2015). Area of land in agriculture in Barabai, Hulu Sungai Tengah varied. Land area is one of the potential areas that is very important in realizing sustainable land use planning (Budiarta, 2014). The potential of the region needs to be identified that can be planned appropriately to developments in the future. In addition to identification of potential areas, it is also necessary to identify land suitability. Regional potential and suitability of land in agriculture in the long term need to be developed to mitigate the problem of food in the future. The active involvement of the community and the government can reduce the impact of climate change (Tompkins and Eakin, 2012; McNeeley, 2012; Permana and Rahaju, 2020).

Procedures

The success of the mapping and identification of potential mitigation of climate change are expected to be able to anticipate the future of food-related issues (Figure 1).
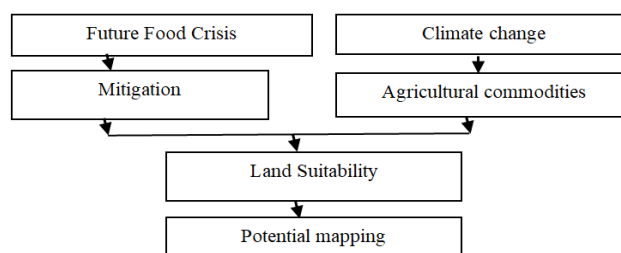

Figure 1. Potential Regional Mapping and Mitigation (Source: Analysis of secondary data and primary data, 2020)

Data analysis

The basis of the research method uses the basic provisions of geography science on the interaction of society and nature, as well as mapping of complex social and natural formations with the help of cartographic models (Nesterchuk et al., 2020). Research used navigational and cartographic hardware and software. The Garmin ETrex Vista was used to obtain coordinate data (Akhmedenov, 2020). The elevation figures were compared and corrected using SRTM.

Methods of data collection using field research and literature. The population and the sample are a land unit and village units. Land units to determine the suitability of land each commodity. Unit villages to collect socio-economic data. Samples were selected and retrieved based on the level of suitability as the sampling frame. The sampling frame is divided into four levels namely S1 (very suitable), S2 (suitable), S3 (marginal suitable), and N (not suitable). Location classification is also included because differences in location result in different sample sizes (Tarin, 2005; Ozdemir, 2000). The research variables are aspects that will be examined in the research (Table 1). The data used are primary data and secondary data. The data collection is done by involving students as enumerators.

Table 1. Variable Research (Source: Analysis of secondary data and primary data, 2020)

No.	Variables		Indicator	Data collection
1.	Mapping the potential of the region	a.	b. Potential Areas,	The questionnaire, laboratory and FGD
			c. Land suitability	
2.	Mitigation		Mitigation of Food Problems	FGD
3.	Recommendations commodities priority	a.	b. Results Identification of Potential Areas,	FGD
			c. Results of Land Suitability,	
			d. Results Mitigation of Food Problems	

Data analysis using quantitative and qualitative approaches (mix method). The analysis technique used was questionnaire scoring, laboratory analysis and spatial analysis to determine land suitability. Location Question analysis techniques, Shift Share, analysis of the results of the Focus Group Discussion (FGD), and spatial analysis to identify potential areas and mitigate food problems (Figure 2). LQ and shift share analysis to determine the economic growth of the region's comparative (Hood, 1998). LQ is a method based on basic economic theories (Rusastra, 2000). Focuss Group Discussion is a systematic process of collecting data and information on a specific problem that is very specific through group discussions, for example to find out problems in agriculture (Roberts et al., 2020). Spatial analysis using Arc GIS software. MS Excel is used in computer systematization, the raster graphics editor Adobe Photoshop, the vector graphics editor Adobe Illustrator is used when creating maps and developing mapping techniques (Nesterchuk et al., 2020). Mapping Potential Region and Land Suitability obtained from the overlay multiple base maps and map the results of field measurements. Map used is a vector-based maps to display information about the area of agricultural land. The data obtained is displayed in the form of maps, tables and graphs.
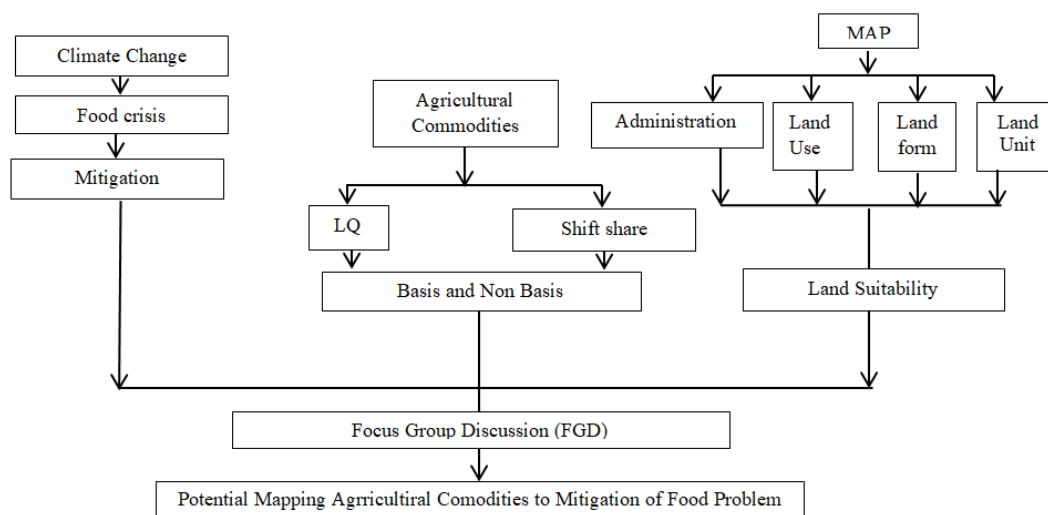
Figure 2. Potential Mapping Agricultural Comodities to Mitigation of Food Problem (Source: Analysis of Secondary Data and Primary Data, 2020)

RESULTS AND DISCUSSION
Result

Agricultural Commodities Research areas include rice, corn, Large Chili, Onions, Oranges and Bananas. Priority commodities are obtained from the land suitability and analysis of the results Soil Laboratory (Table 2 and Figure 3). Laboratory results showed the District has land suitability Barabai S1, S2 and S3. Suitability to the rice crop is S1 (Very Suitable). Corn, chili, orange and banana land suitability S2 (Suitable), as well as the onion is S3 (Marginal Suitable). The results of the land suitability analysis support the results of LQ (Table 3). Corn, bananas, oranges, and great chili as having a sector basis suitability S2 class that can be developed in the study area. Main Commodity based results Identifying Potential and Land Suitability in the village Ayuang, Banua Binjai and Awang Besar (Table 4 and Figure 4).

Table 2. Priority of Land Suitability Results in Research Areas (Source: Primary Data Processing, 2020)

No.	Commodity	Village			
		S1	S2	S3	N
1	Rice	Banua Binjai, Ayuang, Pajukungan, Awang Besar, Kayu Bawang, Babai, Bakapas, Banua Jingah, Mandingin, Gambah, Benawa Tengah, Banua Budi, Bukat, Barabai Darat		Barabai Barat, Barabai Selatan,Barabai Timur, Barabai Utara	
2	Corn		Babai, Banua Binjai, Ayuang, Pajukungan, Awang Besar, Gambah, Kayu Bawang, Banua Budi, Banua Jingah, Mandingin	Bakapas, Barabai Barat, Barabai Darat, Barabai Selatan,Barabai Timur, Barabai Utara, Benawa Tengah, Bukat	
3	Large Chili		Awang Besar, Kayu Bawang	Banua Binjai, Ayuang, Bakapas, Babai, Banua Budi, Barabai Barat, Barabai Darat, Barabai Selatan,Barabai Timur, Barabai Utara, Benawa Tengah, Bukat, Gambah, Mandingin, Pajukungan, Banua Jingah.	
4	Red onion			Banua Binjai, Ayuang, Bakapas, Awang Besar, Babai, Banua Budi, Barabai Barat, Barabai Darat, Barabai Selatan,Barabai Timur, Barabai Utara, Benawa Tengah, Bukat, Gambah, Kayu Bawang, Mandingin, Pajukungan, Banua Jingah.	
5	Orange		Kayu Bawang	Banua Binjai, Ayuang, Bakapas, Awang Besar, Babai, Banua Budi, Barabai Barat, Barabai Darat, Barabai Selatan,Barabai Timur, Barabai Utara, Benawa Tengah, Bukat, Gambah, Mandingin, Pajukungan, Banua Jingah.	
6	Banana		Babai, Ayuang, Banua Jingah, Kayu Bawang, Awang Besar	Banua Binjai, Bakapas, Banua Budi, Barabai Barat, Barabai Darat, Barabai Selatan,Barabai Timur, Barabai Utara, Benawa Tengah, Bukat, Gambah, Mandingin, Pajukungan	

Information:
S1 = Very Suitable   S3 = Marginal Suitable
S2 = Suitable   N = Not Suitable

Table 3. Main Commodity based results Identifying Potential and Land Suitability in the Research Area (Source: Primary Data Processing, 2020)

No.	Commodities	Priority 1	Priority 2	Priority 3
1	Rice	Babai, Banua Binjai, **Ayuang,** Pajukungan, Awang Besar,Kayu Bawang	Banua Binjai, Ayuang	Banua Binjai, Ayuang
2	Corn		**Banua Binjai,** Pajukungan, Awang Besar, Kayu Bawang	Pajukungan, Babai
3	Red onion			Banua Binjai
4	Chili		Babai	**Awang Besar,** Pajukungan
5	Banana			Banua Binjai, Kayu Bawang
6	Orange	Babai		Babai, Awang Besar, Kayu Bawang

Table 4. Pilot Village Main Commodity in the Research Area (Source: Primary Data Processing, 2020)

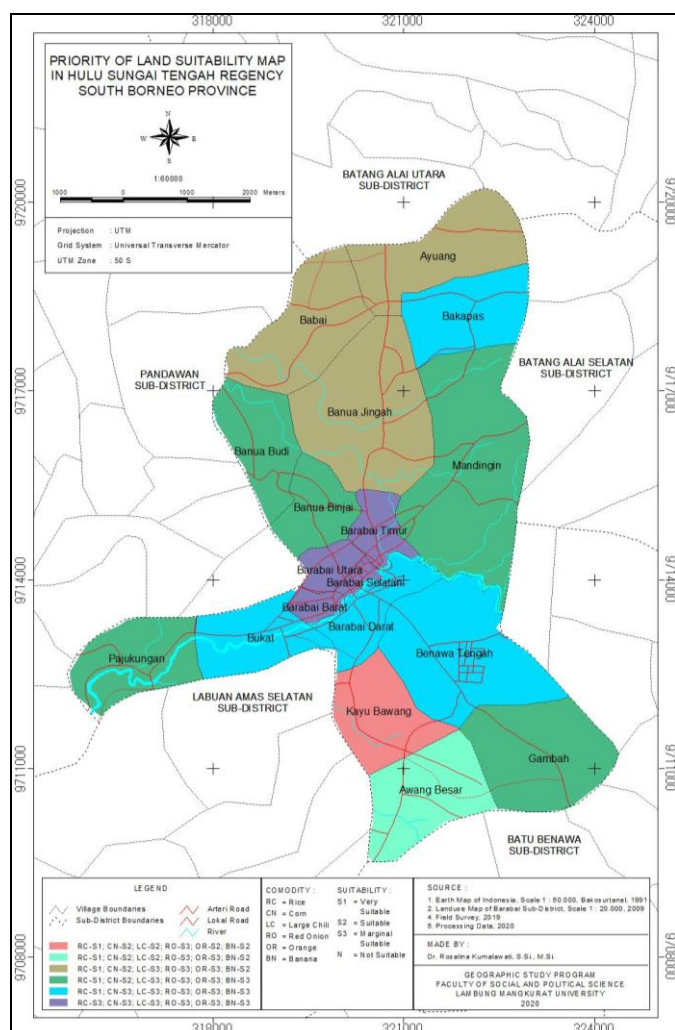| Priority	P1	P2	P3
Main Commodity	Rice	Corn	Chili
Village	Ayuang	Banua Binjai	Awang Besar
LQ	Non-Base	Base	Base
Shift Share	-	-	+
Land Suitability	S1	S2	S2

Figure 3. Priority of Land Suitabilty Map in Hulu Sungai Tengah Regency South Borneo Province (Source: Primary Data Processing, 2020)
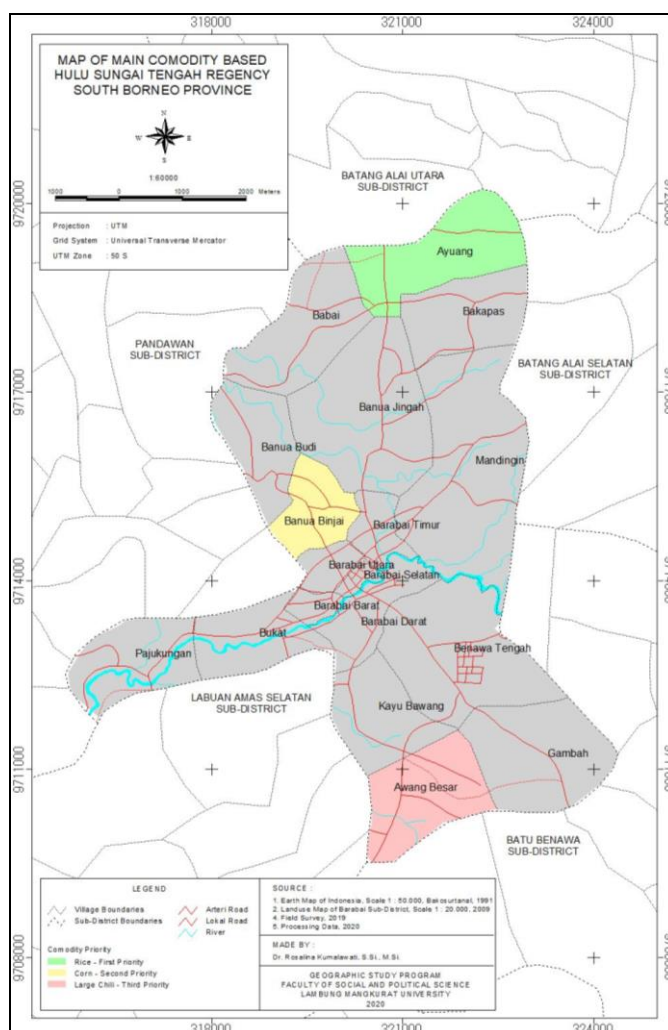
Figure 4. Map on Main Commodity Based Hulu Sungai Tengah Regency Sout Borneo Province (Source: Primary Data Processing, 2020)

DISCUSSION
Priority of Land Suitability Results in Research Areas

Land suitability laboratory results and questionnaire validated with a Focus Group Discussion (FGD). Results obtained validation featured priority for each commodity agriculture in each village. Commodity Priority 1 namely rice, and oranges in the village of Babai, Banua Binjai, Ayuang, Pajukungan, Awang Besar, Kayu Bawang. Priority 2, namely rice, corn, and chili in the village of Banua Binjai, Ayuang, Pajukungan, Awang Besar, Kayu Bawang and Babai. Priority 3 is the lead all commodities in the village of Banua Binjai, Ayuang, Pajukungan, Babai, Kayu Bawang, Babai, and Awang Besar (Table 3).

Main Commodity based results Identifying Potential and Land Suitability in the Research Area

Commodity Priority 1 is Rice Village Ayuang become pilot areas. Commodity Priority 2 namely corn in Banua Binjai, commodity Priority 3 that Chili in the village of Awang Besar (Table 4 and Figure 4). Development of agricultural commodities just do not think the type of commodity to be developed but also about marketing and transportation. Marketing requires market economic conditions for all business entities that can be viewed as a socio-economic system (SES) to be competitive (Ginevicius, 2019; Dzurov et al., 2020). Competitiveness can be seen from an economic and psychological point of view (Piotrowska, 2019). Transportation is needed for marketing so that efficiency, level of safety, quantity and quality of services for transportation and cargo, environmental protection need to be considered (Pidgirna et al., 2020). Transportation logistics is a factor in realizing the geostrategic potential of an area and determining marketing success (Pohuda et al., 2018). In addition, the processing of commodities should also be developed in order to have more value and increase farmers' income (Kristiawan et al., 2016). Limitations of the study did not examine whether there is a threat in the area of research that could potentially lead to crop failure. The most common pest that appears and is still ignored by farmers is the Parasite Nematoda (PPN) as in the province of East Kalimantan (Suyadi and Rosfiansyah, 2017). Farmers, especially in developing countries are not aware of the existence of PPN (Jones et al, 2013). PPN attack rice plants can cause loss of up to 87%. PPN and Antraknosa can attack the banana plant (Rumahlewang, 2012). Banana losses due to PPN of more than 50% (Bartholomew et al. 2014) or ranging from 30 to 60%

(Brooks, 2008). PPN can also cause yield losses of up to 75% on bananas (Holscher et al., 2014). It is most prevalent in developing countries such as Indonesia due to parasite control efforts are still limited (Chitamba et al., 2013; Kamira et al., 2013; Srinivasan et al., 2011).

Red Onion (*Allium Ascalonicum*) is one of vegetables that have high economic value (Safitri et al., 2019). Spacing should be considered in planting Red Onion (Nugrahini, 2013). Obstacles to plant onions especially outside the growing season of the rainy season the risk of disease and affects production (Kusmiadi et al, 2015). Losses due to disease reaches 24-100% (Udiarto et al, 2005). Disease that often attacks the onions are anthracnose Isnawan, and Mubarok, (2014). 2015 Onion began to be developed in South Kalimantan (Safitri et al., 2019). Seeing this much needed further research on types of pests that can affect the productivity of agriculture commodities in the research area. At this time, research in agriculture has attracted much attention (Fritz and Miller, 2003; Stair et al., 2012; Roberts, 2020). However, with a participatory approach namely through FGD, this research provides a unique insight into how the community can overcome agricultural problems due to climate change. Furthermore, symbolic interactionism (Crotty, 1998) serves to recount the findings that have emerged. Nonetheless, we recommend that future investigations design research studies using a variety of conceptual and theoretical perspectives about agriculture. Perhaps by examining this phenomenon with a bottom up approach and a different set of assumptions, more precise solutions can be found on future agricultural problems. We also point out opportunities for future research and practice related to agriculture, for example regarding the types of pests that affect agricultural productivity.

CONCLUSION

Results showed that corn and chili LQ has a base sector, while other sectors have the non-base. Shift-share value is negative (-) except chili. FGD results indicate the commodities to be developed by the community are rice, corn, and chili. Rice, corn and chili as having a sector basis suitability classes S1 and S2 that can be developed in the research area.

The development of the agricultural sector must be followed by the development of the marketing and processing of commodities so as to increase incomes. Limitations of the study did not see if there was a threat in the area of research that could potentially lead to crop failure. However, further research needs to be done is about the types of pests that can affect productivity.

Acknowledgements

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