

## IMPACT OF PANDEMIC COVID-19 ON ENVIRONMENTAL AND AGRICULTURE IN THE PROVINCE OF GORONTALO

**Iswan Dunggio<sup>1\*</sup>, Sofyan Abdullah<sup>2</sup>, Risma Neswati<sup>3</sup>**

<sup>1</sup>Postgraduate Lecturer in Population and Environment, State University of Gorontalo

<sup>2</sup>Lecturer of the Faculty of Agriculture, University of Gorontalo

<sup>3</sup>Lecturer of the Department of Soil Science, Faculty of Agriculture, Hasanuddin University Makassar

\*Corresponding email: [is\\_onex@yahoo.com](mailto:is_onex@yahoo.com)

Doi: 10.20956/ecosolum.v10i1.14235

### ABSTRACT

Corona virus disease Covid-19 is a deadly virus and was first discovered in Wuhan, China. This virus has spread throughout the world and has an impact on the environment and Agriculture. The impact on the environment is an increase in waste congeries, a decrease in energy consumption, a decrease in air pollution, while the impact of Covid-19 on the Indonesian economy includes negative economic growth, an increase in the number of poor people and an increase in unemployment. This study aims to analyze the impact of Covid-19 on the environment and agriculture in Gorontalo Province. This study uses a qualitative approach where data is collected from interviews and literature searches from official sources. The results showed that the impact of Covid-19 on environmental conditions in Gorontalo Province, among others, was an increase in waste production by 9.17% during Covid-19 in 2020, and an increase in the use of medical waste for Covid-19 by 33.3% in the fourth quarter of 2020. The use of electrical energy has increased by 6.7% during the Covid-19 pandemic in 2020. As for impact on agriculture contribution of the agricultural sector to GDP was relatively stable, rice production increase 4.1%, but fish production fell by 0.18% and coconut fell 0.11%. This condition can raise farmers term of trade during the 3<sup>rd</sup> and 4<sup>th</sup> quarters in 2020.

Keywords: Covid-19, environment, agriculture

### INTRODUCTION

Corona virus disease that first appeared in 2019 (Covid-19) in Wuhan China is one of the dangerous viruses because it spreads very quickly (Wu, et al, 2020; Xiaorong et al, 2020; Huang et al, 2020). The environmental, social and economic impacts in the midst of the Covid-19 pandemic are one of the issues that are often reviewed and discussed on various media platforms. The impact caused by Covid-19 can lead to positive things but on the one hand it can also have a negative impact and this impact can be short-term and long-term (Karunathilake, 2020; Adiyoso, 2020). At the time of writing, the total number of positive Covid-19 cases worldwide reached 150,224,795 (Worldmeter April 29, 2021 <https://www.worldometers.info/coronavirus/> ) with a death toll of 3,163,964, while in Indonesia it reached 1,657,035 cases with a death toll of 45,116 cases. The case of Covid-19 transmission in Gorontalo Province occurred on April 9, 2020, which was an imported case at a religious event held in Gowa, South Sulawesi. Gorontalo Province was the last region in Indonesia to report Covid-19 transmission. The total number of Covid 19 cases in Gorontalo Province as of this writing has reached 5,382 (Satgas Covid-19 Province of Gorontalo April 29, 2021 <https://dinkes.gorontalooprov.go.id/covid-19/>) cases with the number of deaths reaching 164 cases. Since entering Indonesia in early March 2020, the Covid-19 pandemic has also changed the focus of national planning, both short-term and long-term in the economic and social fields, especially in the fields of poverty reduction and health assistance.

Economic growth in several countries such as the United States, China, Hong Kong, South Korea, Britain and most of the European Union countries began to experience a decline. The economic recession in several countries had a negative impact on Indonesia's economic growth.

According to Wuryandani (2020), the first quarter since Covid-19 was first discovered in Indonesia, economic growth contracted at the level of -4.19%. Several steps have been taken by the government to control the spread of Covid-19, such as implementing the 3 m health protocol, namely wearing masks, washing hands and maintaining distance and social protection policies through social assistance schemes. Social assistance which includes 7 types of assistance such as basic food assistance, cash social assistance, direct cash assistance (BLT) for village funds, free electricity, pre-employment cards, employee salary subsidies and micro-enterprise BLT. According to Kacaribu (2020) the provision of social assistance is carried out by the government so that public consumption is maintained and strengthens resilience for the poor and vulnerable to the poor. According to UNICEF (2021) if the Indonesian government does not implement social assistance programs, there is a potential for an increase in the poverty rate of 1.3 million working children. Furthermore, according to Paramo's opinion (2020) that the Covid-19 pandemic crisis is a major crisis where the poor find it difficult to get access to health and lose their jobs. The potential for job loss in the short term causes access to quality education to decline which has an impact on the decline in the quality of human resources. The environmental aspect also shows that the air conditions in several big cities in the world such as China, Paris, Madrid and Rome are better off because of the reduction in pollutant gases or nitrogen dioxide (NO<sup>2</sup>). In the February 2020 period in the Chongqing region, there was a 45% decrease in nitrogen dioxide pollutant gas compared to February 2019. However, in the February 2021 period, an increase began again, this data is taken from the Copernicus Sentinel-5P satellite (European Space Agency (ESA) image, 2021).

Meanwhile, according to Jonarsih (2020) in Indonesia, especially the air quality in Jakarta, there was a significant change after the DKI Jakarta government implemented PSBB, there was a decrease in pollutant gases of around 40% compared to 2019. But the decrease did not occur in air pollutants of the type PM 2.5 (concentration of particulate pollution is small), the PM 2.5 figure is still high. According to World Health Organization (WHO) standards, the maximum limit for PM 2.5 concentration is 25 micrograms per cubic meter, while the data on January 1 until the PSBB was enforced on April 22, the PM 2.5 figure in Jakarta was still above the WHO standard. However, ESA (2021) and Jonarsih (2020) predict that the potential for air pollution will increase along with the reopening of community and industrial activities.

According to Pulubuhu et al (2020) said that the agricultural sector in Indonesia experienced a slowdown in growth due to social restrictions and restrictions on distribution traffic, this situation could cause agricultural prices to rise and the quality of agricultural commodities to decline. Data shows that the agricultural sector still grew 2.19% in the first quarter of 2020, This growth is lower than in the first quarter of 2019 which reached 5.3%, this decline occurred due to restrictions on the distribution channel

transportation system (Rahman, 2020). The purpose of the study was to conduct a descriptive analysis of the impact of Covid 19 on environmental and agricultural conditions in Gorontalo Province.

## **RESEARCH METHODS**

The research was conducted for 3 months starting from December 2020-March 2021 and was carried out in Gorontalo Province. This research is a descriptive-qualitative research. According to Masinambow and Gosal (2020), descriptive research is one type of research whose purpose is to present a complete picture of a social setting or is intended to explore and clarify a phenomenon or social reality by describing a number of variables relating to the problem and unit under study between the phenomenon under test. This research emphasizes the iterative process of an object under study so as to get results that are close to a real reality (Asper and Corte 2019).

The purpose of descriptive research is to produce an accurate picture of a group, describe the mechanism of a process or relationship, provide a complete picture either in verbal or numerical form, present basic information about a relationship, create a set of categories and classify research subjects, explain a set of stages or processes, and to store contradictory information about the research subject. Data was collected by means of literature study, observation, semi-structured interviews while data analysis was carried out by exploring field notes and interview results as revealed by Busseto et al. (2020) presenting basic information about a relationship, creating a set of categories and classifying research subjects, explaining a set of stages or processes, and for storing contradictory information about the research subject.

Data was collected by means of literature study, observation, semi-structured interviews while data analysis was carried out by exploring field notes and interview results as revealed by Busseto et al. (2020) presenting basic information about a relationship, creating a set of categories and classifying research subjects, explaining a set of stages or processes, and for storing contradictory information about the research subject. Data was collected by means of literature study, observation, semi-structured interviews while data analysis was carried out by exploring field notes and interview results as revealed by Busseto et al. (2020) semi-structured interviews while data analysis was carried out by exploring field notes and interview results as revealed by Busseto et al. (2020) semi-structured interviews while data analysis was carried out by exploring field notes and interview results as revealed by Busseto et al. (2020).

## **RESULTS AND DISCUSSION**

### **A. Environmental Impacts**

#### **1. Energy Use**

When several countries imposed large-scale social restrictions during the period from May to August, energy consumption decreased between 15% - 17% in China and Europe (International Energy Agency, 2020). As a result of declining energy consumption, the International Monetary Fund (2020), predicts

a decline in the global economy that reaches an average of 3%. Air and road travel delays imposed by several countries have also resulted in a 50% reduction in pollution in 2019 and another 60% decline in the first quarter of 2020 (Jiang et al, 2021; IEA, 2020; Leal Filho et al, 2020). During the pandemic that took place between 2019-2020, there was a decrease in electricity consumption in Indonesia by 1.01 kwh/per capita, whereas in 2019 electricity consumption reached 1.08 kwh/capita. The decline in electrical energy consumption is caused by a decrease in electrical energy consumption in the business and industrial sectors, which are the largest customers of electrical energy. However, this does not happen in electricity consumption in Gorontalo Province, BPS data (2021) shows electricity consumption in 2020 increased by 6.7% compared to electricity consumption in 2019. Electricity sold in 2020 reached 611,616 MWh compared to 2019 which only reached 543.841 MWh. This increase is due to the fact that electricity customers in Gorontalo Province generally come from households. Social restrictions and government instructions to work from home have made the household segment's electricity consumption increase. In addition, this increase is not too large due to a decrease in people's purchasing power during the Covid-19 pandemic (figure 1).

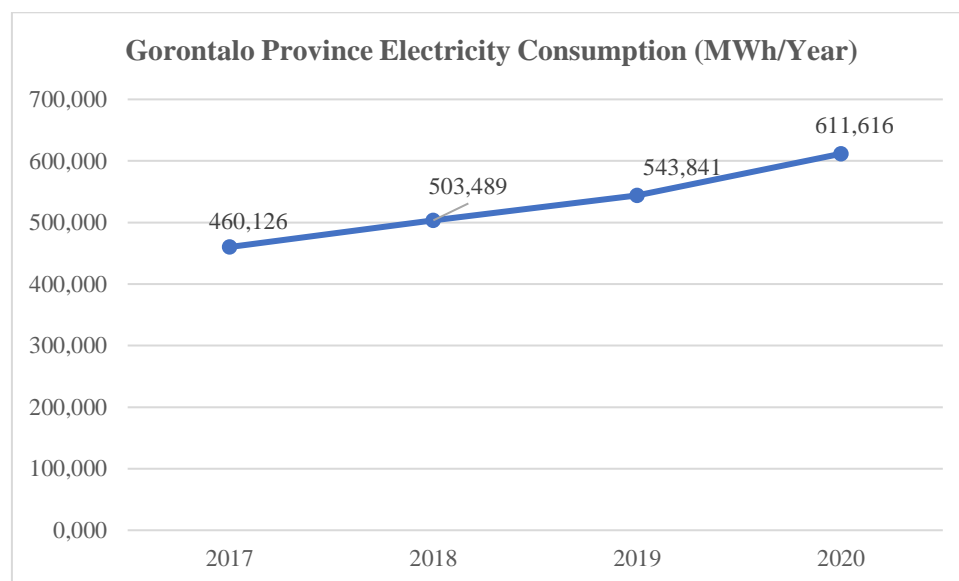


Figure 1. Electricity consumption in Gorontalo province before and during the 2019-2020 pandemic (Results of BPS data analysis)

Several indicators of energy use in Gorontalo Province such as electricity and fuel use fluctuated. Based on the information collected, consumption of non-subsidized fuel oil (BBM) in Gorontalo Province during April-May 2020, fuel consumption had fallen to IDR4.7 billion, but this figure rose again from June to October with a value of IDR6.8 billion. The biggest increase occurred in pertalite RON90 fuel consumption.

## Waste Congeries

Since it first broke out in Wuhan, China in December 2019 and spread throughout the world, the world's social, economic and environmental situation has been in an unpredictable situation (Rowan and Laffey, 2020; Guan, et al, 2020; Reid et al, 2020) to be included in Indonesia, since then the health protocol has been implemented strictly. One of these protocols is the use of medical masks. According to Tripathy et al (2020), since the pandemic hit almost all over the world, there has been a shift in community activities at all age levels that have an impact on the accumulation of waste congeries such as the use of masks, gloves to the use of single-use plastic which some people have started to avoid contact with. with Covid-19, for example in a hospital in Wuhan, an average of 240 metric tons of medical waste was generated during the outbreak, whereas before the pandemic outbreak occurred, the average medical waste was only around 50 metric tons. The Covid 19 pandemic in Gorontalo Province which began in April 2020 has also generated a volume of medical waste for handling Covid-19 in Gorontalo Province as shown in figure 2.

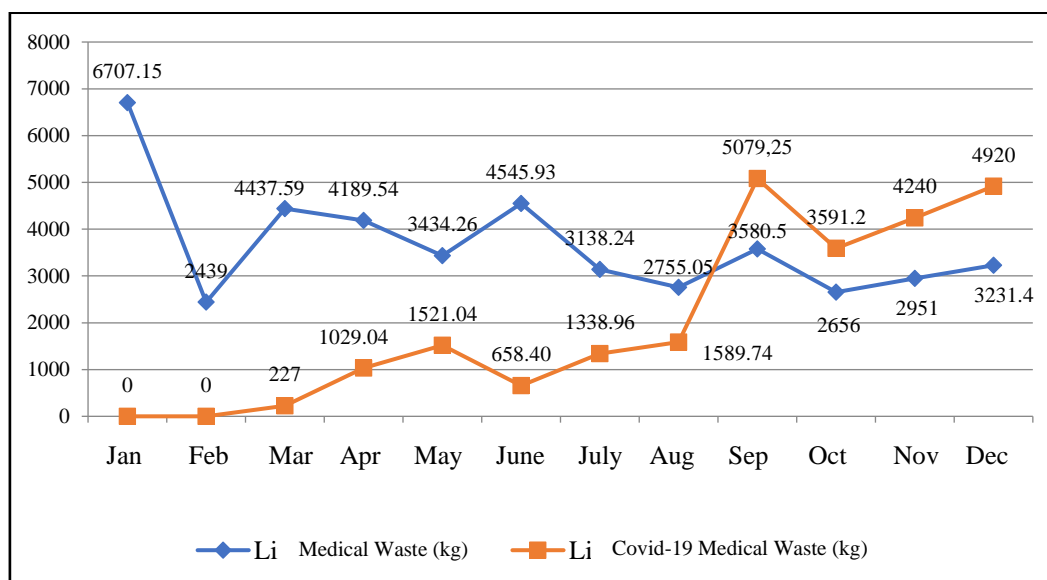


Figure 2. The Congeries of non-covid medical waste and covid medical waste in 2020 (Gorontalo Provincial Health Office, 2021)

Based on the figure above, it shows that Covid-19 medical waste has increased by 31.3% in the 4th quarter of 2020 and this figure continues to be above waste congeries non-Covid-19 medical. The increase in medical waste congeries is due to the intensification of local governments in carrying out swab tests to the public. The swab test was carried out to prevent the spread of Covid-19 in Gorontalo Province. Furthermore, several countries that have imposed large-scale social restrictions have actually increased domestic consumption activities where food and necessities are purchased online with the excuse of maintaining food stocks (Zambrano-Monserrate, et al 2020).

The surge in the use of plastic waste, especially in urban areas, increased sharply as revealed by Jonarsi (2020) who said that plastic waste increased by 400% when people made transactions in several

e-commerce sites such as Tokopedia, Shopee and Bukalapak between March 2 and April 5, 2020. Some restaurants or restaurants apply a take away system and use plastic to wrap their food. The biggest challenge in anticipating a surge in waste, especially in cities, is the limited transportation fleet and waste transporters, The shift system becomes irregular because on the one hand the movement of waste transporters is also limited, so that the transportation of waste, especially medical waste, will take longer, even though the longer the waste is not transported, the greater the potential for Covid 19 transmission. As revealed by Chin et al. (2020), that SARS-CoV-2 is able to survive on hard objects for approximately 3 days.

The results of data analysis on waste congeries in Gorontalo Province showed that there was an increase in waste congeries of 9.17% in 2020 or when Covid-19 hit Gorontalo Province. Even though the longer the waste is not transported, the greater the potential for Covid-19 transmission. As revealed by Chin et al. (2020), that SARS-CoV-2 is able to survive on hard objects for approximately 3 days. The results of data analysis on waste congeries in Gorontalo Province showed that there was an increase in waste congeries of 9.17% in 2020 or when Covid-19 hit Gorontalo Province. Even though the longer the waste is not transported, the greater the potential for Covid-19 transmission. As revealed by Chin et al. (2020), that SARS-CoV-2 is able to survive on hard objects for approximately 3 days. The results of data analysis on waste congeries in Gorontalo Province showed that there was an increase in waste congeries of 9.17% in 2020 or when Covid-19 hit Gorontalo Province.

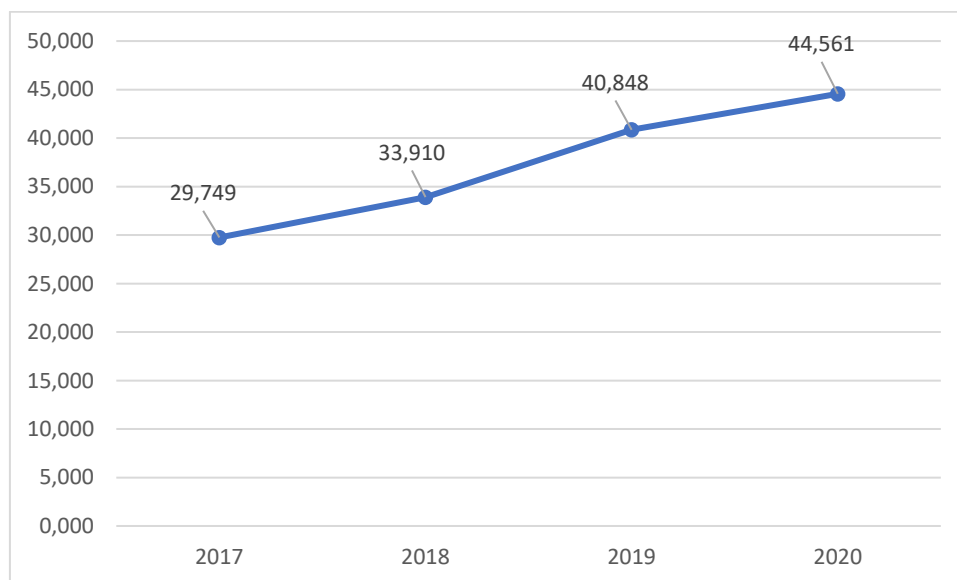


Figure 3. Condition of waste congeries before and during Covid-19 in 2020 (Department of Environment and Forestry of Gorontalo Province, 2021)

### Impact on agricultural land

The most significant impact of Covid-19 on soil and water conditions is the increasing accumulation of food originating from human food scraps and leftovers from agricultural products such as vegetables, meat and milk that are not distributed to consumers as a result of closing border gates both between

provinces and even between provinces. between countries for reasons of prevention against the spread of Covid-19. Many farmers are forced to throw back their agricultural products, where the cheapest and easiest way is to bury them back into the ground (Web Soil Survey, 2020; Deaton, 2020).

According to Pol, (2019), throwing food waste into the soil can cause a decrease in the concentration of soil organic matter around the root area and will have a negative impact on agricultural productivity developed by small farmers (Wood, et al, 2018). Lal, (2020) said that the Covid-19 pandemic which destroyed the social and economic order of the world was the result of large human interactions with nature such as deforestation, uncontrolled land clearing and massive input of inorganic fertilizer. This situation has a negative impact on the condition of agricultural lands. The significant impact felt is the increasing exclamation of critical lands, including in Gorontalo Province, especially in agricultural areas or areas outside the state forest area as revealed in the update report on critical lands of the Bone Bolango Watershed and Protected Forest Management Center (BPDAS HL Bone). Bolango, 2020) (2020) said the Covid-19 pandemic that destroyed the social and economic order of the world was the fruit of the large number of human interactions with nature such as deforestation, uncontrolled land clearing and massive input of inorganic fertilizers. This situation has a negative impact on the condition of agricultural lands. The significant impact felt is the increasing exclamation of critical lands, including in Gorontalo Province, especially in agricultural areas or areas outside the state forest area as revealed in the update report on critical lands of the Bone Bolango Watershed and Protected Forest Management Center (BPDAS HL Bone).

Bolango, 2020) (2020) said the Covid-19 pandemic that destroyed the social and economic order of the world was the fruit of the large number of human interactions with nature such as deforestation, uncontrolled land clearing and massive input of inorganic fertilizers. This situation has a negative impact on the condition of agricultural lands. The significant impact felt is the increasing exclamation of critical lands, including in Gorontalo Province, especially in agricultural areas or areas outside the state forest area as revealed in the update report on critical lands of the Bone Bolango Watershed and Protected Forest Management Center (BPDAS HL Bone). Bolango, 2020) This situation has a negative impact on the condition of agricultural lands. The significant impact felt is the increasing exclamation of critical lands, including in Gorontalo Province, especially in agricultural areas or areas outside the state forest area as revealed in the update report on critical lands of the Bone Bolango Watershed and Protected Forest Management Center (BPDAS HL Bone). Bolango, 2020). This situation has a negative impact on the condition of agricultural lands. The significant impact felt is the increasing exclamation of critical lands, including in Gorontalo Province, especially in agricultural areas or areas outside the state forest area (figure 4) as revealed in the update report on critical lands of the Bone Bolango Watershed and Protected Forest Management Center (BPDAS HL Bone). (Bolango, 2020).

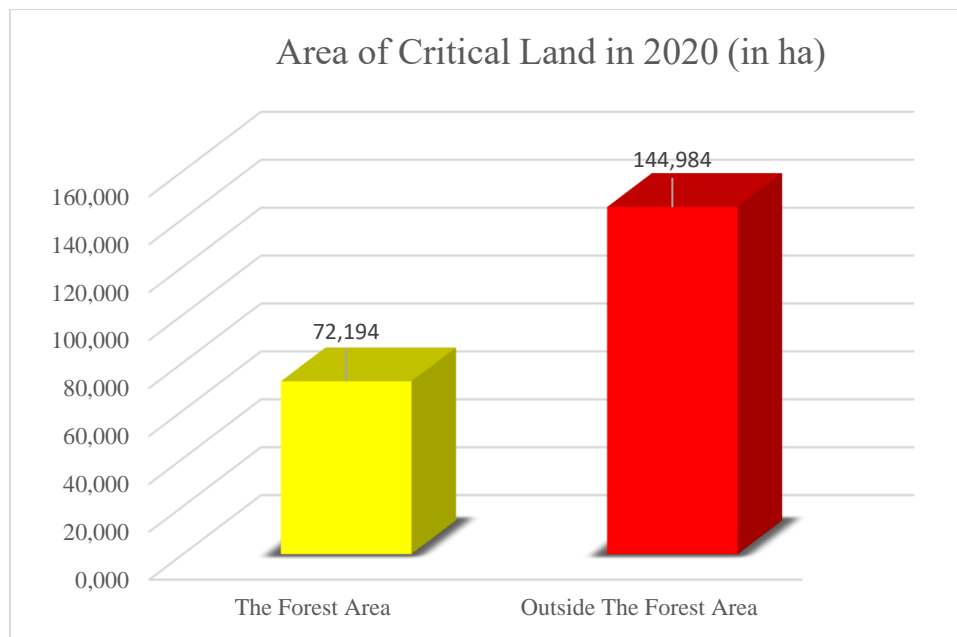


Figure 4. Critical area in other use areas (outside forest areas) and within forest areas (Source: BPDASHL Bone Bolango, 2020)

## B. Economic impact

The International monetary fund (IMF) (2020) has predicted that the Covid-19 pandemic could cause global economic growth to fall by 4.4% and this is the largest recession in the history of the world economy since the second world war. The biggest impact of Covid-19 on the economy in Gorontalo Province is social restrictions which have an impact on the running of the economy in Gorontalo Province. This situation will last for an unknown time considering the impact of Covid-19 is very wide and has hit almost the entire world. Layoffs, business closures and declining natural resource production are global challenges (Chinazzi, 2020; Mofijur, et al. 2021). This is in line with that expressed by Mofijur, et al. The impact of the Covid-19 attack on the economy, especially the business sector, seems to have shaken the Indonesian economy. Indonesia's economic growth report between January-March 2020 is only around 2.94%. This growth rate decreased by 4.97% in the fourth quarter of 2019. Indonesia's economy again declined dramatically in the second quarter where economic growth was at -5.32%. The impact of Covid-19 on the economy in Gorontalo Province also appears to be decreasing, although the decline is not too large when compared to national economic growth. In general, economic growth in Gorontalo Province is only below -1% (figure 5). Boalemo Regency is an administrative area with a lower rate of economic growth compared to other regions in Gorontalo Province.



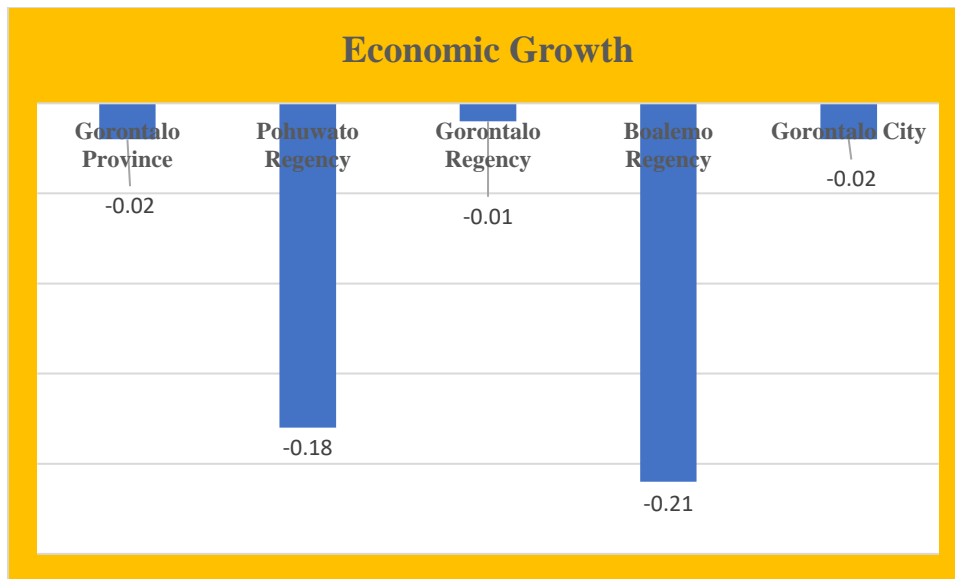


Figure 5. Economic growth of Gorontalo Province during the Covid 19 period in 2020 (in %) (BPS, 2021)

The decline in economic growth to minus numbers, has the potential for, among others, an increase in the number of poor people, an increase in the unemployment rate and a decrease in agricultural production. Nationally, the number of poor people in 2020 has increased by 10.19%. The number of poor people in September 2020 was 27.55 million people, an increase of 1.13 million people against March 2020 and an increase of 2.76 million people in September 2019. The percentage of the urban poor in March 2020 was 7.38 percent, up to 7.88 percent in September 2020. Meanwhile, the percentage of the rural poor in March 2020 was 12.82 percent, rising to 13.20 percent in September 2020. Meanwhile, the number of poor people in Gorontalo Province also experienced a decline after being hit by the Covid-19 pandemic (figure 6).

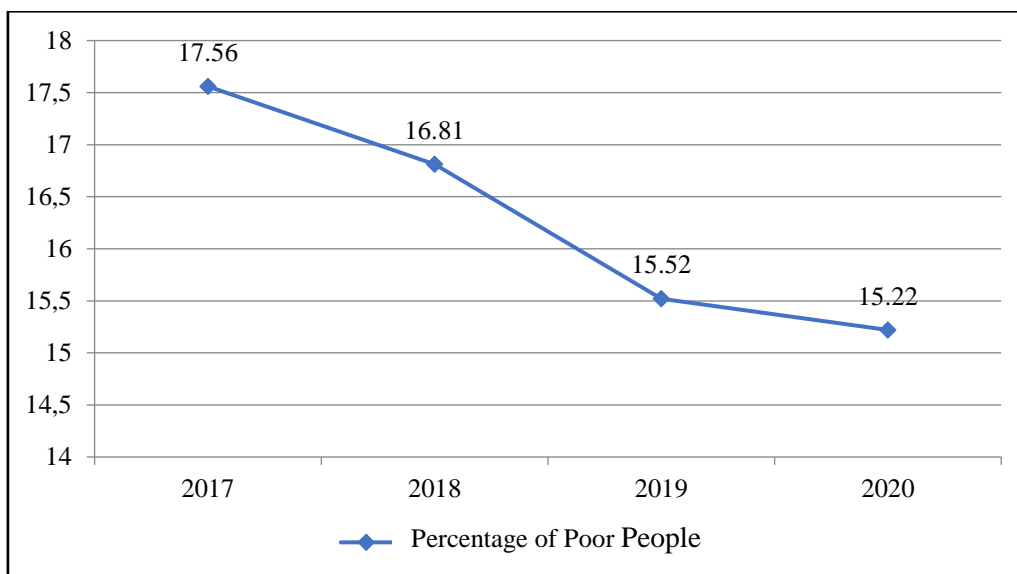


Figure 6. Percentage of poor people before and during the Covid 19 pandemic

The lack of an increase in the poor during Covid-19 in 2020 in Gorontalo Province was caused by several things, such as the low inflation rate, especially in March -0.13%, April -0.08% and May -0.33% (BPS, 2021). Negative inflation means that the prices of goods and services are lower than in the same month the previous year. The highest inflation was in June which reached 0.37%, however this inflation was relatively small. This is also supported by the price of basic necessities which tend to be stable during Covid-19. According to FAO estimates (2020), the most significant impact of poverty will be seen in urban communities who are highly dependent on the supply of goods and services originating from rural areas. Generally, rural areas supply commodities based on agriculture, plantations and fisheries. During the Covid-19 pandemic, the Gorontalo Provincial government did not impose micro-scale social restrictions where there was strict security in every administrative area in one province. So that the distribution of agricultural commodities from rural areas is actually not disturbed. Several reasons for staple foods tend to be stable, among others, due to government intervention through the provision of social assistance and the contribution of the agricultural sector to the GRDP of Gorontalo Province is still relatively stable. If you look at the data in figure 7, the contribution of the fisheries sector is 0.53% during 2020, this figure has increased when compared to fishery production in 2019. The contribution of the forestry sector tends to be stable while the total contribution of the agricultural sector has decreased by 0.

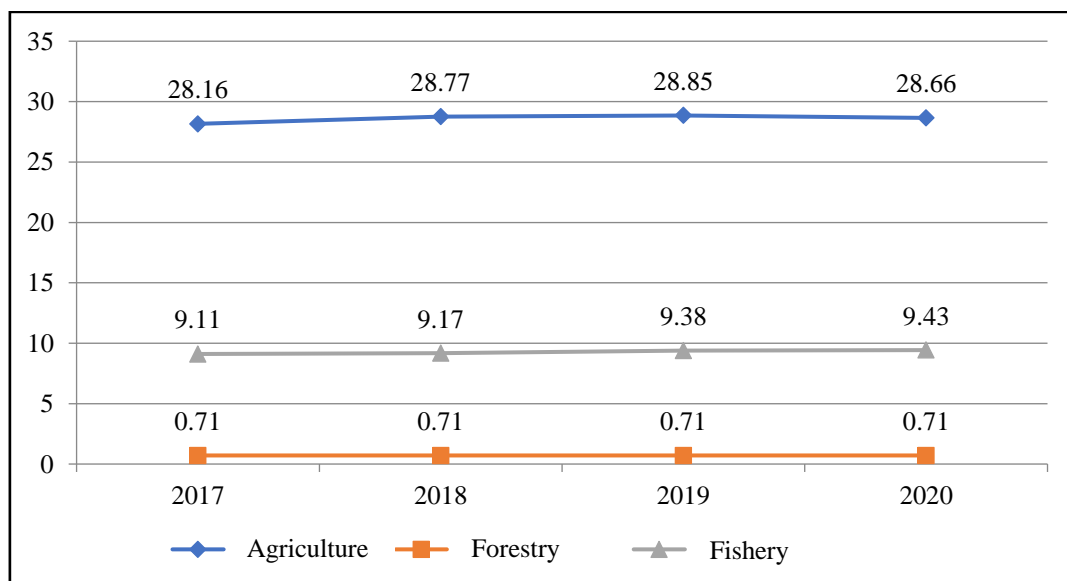


Figure 7. Contribution of agriculture, forestry and fishery sectors to GRDP in Gorontalo Province (in %) (BPS, 2021)

One of the concerns about the impact of Covid-19 on the agricultural sector, namely the reduced demand for agricultural commodities due to restrictions on social activities, the closure of ports for exports so that it greatly disrupts the supply chain of agricultural commodities as revealed by Paramo (2020) has not yet occurred in Gorontalo Province. The agricultural sector has not been disrupted as a

result of Covid-19 in Gorontalo Province because basic needs for the residents of Gorontalo Province are generally supplied from various regions in Gorontalo Province. Data shows that during Covid-19 the mainstay agricultural sectors such as rice and corn, were able to grow, even rice production increased by 4.1% during 2020, however, the fisheries sector decreased by 0.18% and coconut fell 0.11% (figure 8).

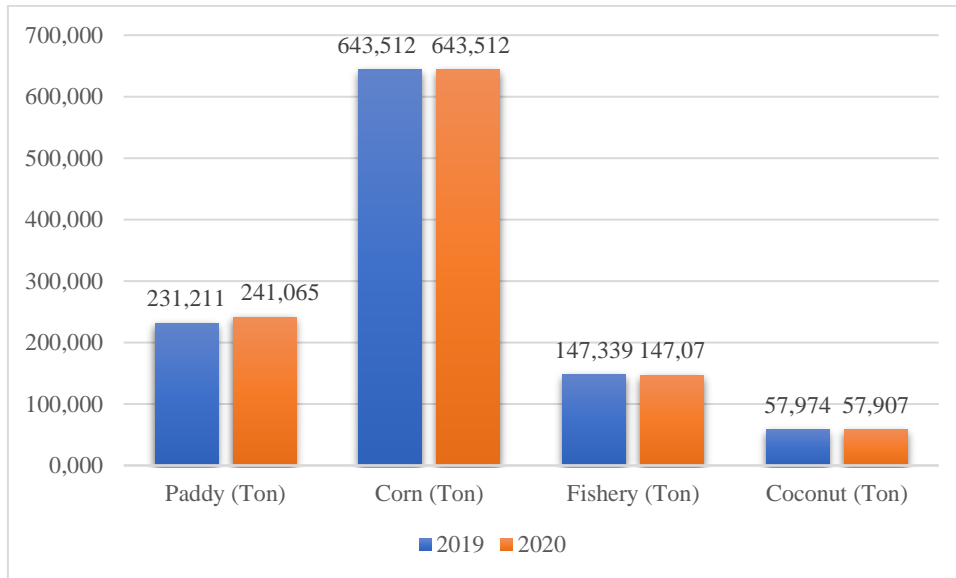


Figure 8. Performance of the agricultural sector of Gorontalo Province during the period 2019-2020

This positive performance was able to boost the exchange rate of farmers in Gorontalo Province. During Covid-19, the exchange rate of farmers in Gorontalo Province tended to increase during the August-December 2020 period (BPS, 2021), only experiencing a slight decline in April 2020 when the Gorontalo Provincial government imposed social restrictions (figure 9).

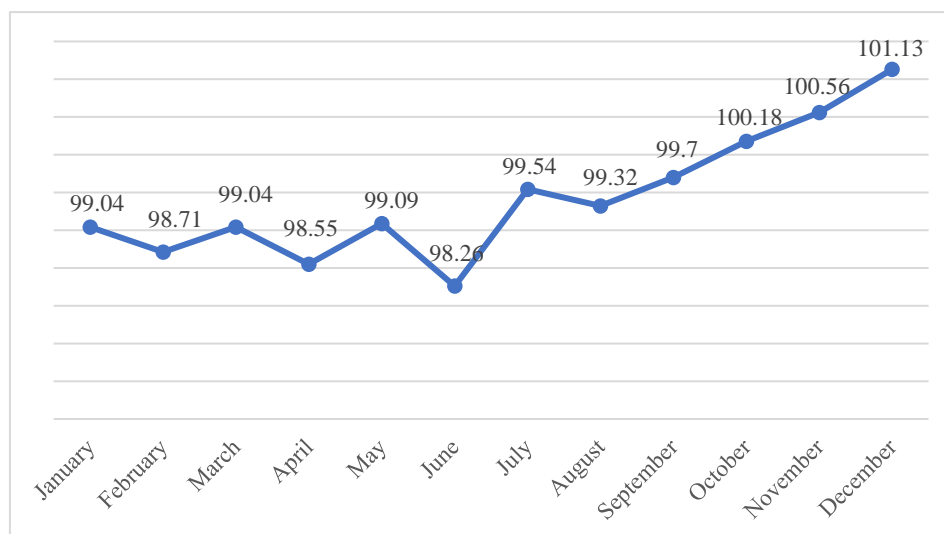


Figure 9. Farmer's exchange rate during 2020 (in %) (BPS, 2021).

## Conclusion

The environmental, social and economic impacts in the midst of the Covid-19 pandemic are one of the issues that are often reviewed and discussed on various media platforms. The impact caused by Covid-19 can lead to positive things but on the one hand it can also have a negative impact and this impact can be short-term and long-term. Some conclusions from the results of this study are:

1. During the pandemic that lasted between 2019-2020, there was a decline in electricity consumption in Indonesia by 1.01 kwh/per capita caused by a decrease in electrical energy consumption in the business and industrial sectors, which are the largest customers of electrical energy. However, this is not the case for electricity consumption in Gorontalo Province, BPS data (2021) shows that electricity consumption in 2020 will increase by 6.7%. This increase is due to the fact that electricity customers in Gorontalo Province generally come from households. Social restrictions and government instructions to carry out activities from home (work from home) make the household segment's electricity consumption increase
2. Waste congeries in Gorontalo Province increased by 9.7% during Covid-19 in 2020, while medical congeries for handling Covid-19 showed an increase of 31.3% in the 4th quarter of 2020
3. Economic growth of Gorontalo Province contracted by -0.02% during Covid -19 where the inflation rate decreased in March -0.13%, April -0.08% and May -0.33.
4. The number of poor people decreased by 15.22% during the 2020 period or during the Covid-19 pandemic
5. The contribution of the agricultural sector to the GRDP of Gorontalo Province was relatively stable which indicates that the agricultural sector is still running well despite the pandemic.
6. The stable contribution of the agricultural sector to GRDP has an impact on the exchange rate of farmers in Gorontalo Province, which has increased.
7. Impact Covid-19 in Gorontalo relatively large influence on the environment (including soil conditions) and relatively no effect on the economic sector, especially in the agricultural sector.

## Suggestions

1. Increase the volume capacity of the capacity of waste congeries (TPA)
2. Encouraging the system of recycling trash into energy source New and renewable products
3. Improving digital services to minimize face-to-face transactions
4. Streamlining the flow of goods and services, especially agricultural commodities,
5. Continuing social protection program policies through cash transfer schemes, labor-intensive programs and the provision of basic food aid.

## Acknowledgments

The author would like to thank the Regent of Gorontalo for approve a short research activity with the theme of the Impact of Covid-19 on the environment and economy. We also express our gratitude to the Head of the Gorontalo Regency Research and Development Agency who has supported this activity to completion.

## References

- Adiyoso, W., 2020. Does the Covid-19 pandemic have any positive impact on SDGs?. *The Journal of Indonesia Sustainable Development Planning* (p.i -iii) Vol. I No. 2-August 2020. E-ISSN: 2722-0842| P-ISSN: 2721-8309
- Aspers, P., & Corte, U. (2019). What is Qualitative in Qualitative Research. *Qualitative sociology*, 42(2), 139–160. <https://doi.org/10.1007/s11133-019-9413-7>
- Badan Pusat Statistik. 2021. Provinsi Gorontalo dalam angka tahun 2021. Badan Pusat Statistik Provinsi Gorontalo
- BPDASHL Bone Bolango. 2020. Update lahan kritis Provinsi Gorontalo tahun 2020
- Busetto, L., Wick, W. & Gumbinger, C. (2020). How to use and assess qualitative research methods. *Neurol. Res. Pract.* 2, 14. <https://doi.org/10.1186/s42466-020-00059-z>
- Chinazzi M (2020). The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. *Science*. 2020; 368(6489):395–400
- Chin, AWH., Julie T.S. Chu, Mahen R.A. Perera, Kenrie P.Y. Hui, Hui-Ling Yen, Michael C.W. Chan, Malik Peiris, Leo L.M. Poon Stability of SARS-CoV-2 in different environmental conditions doi: <https://doi.org/10.1101/2020.03.15.20036673>
- Deaton, B.J. 2020. Food security and Canada’s agricultural system challenged by COVID-19. *Can. J. Agric. Econ. Can. d’agroeconomie* 2020. <https://onlinelibrary.wiley.com/doi/full/10.1111/cjag.12227>
- Dinas Kesehatan. 2021. Data limbah B3 dan limbah medis Covid-19 Provinsi Gorontalo. Dinas Kesehatan Provinsi Gorontalo. (Tidak dipublikasikan)
- Dinas Lingkungan Hidup dan Kehutanan. 2021. Data Timbulan Sampah Provinsi Gorontalo. Dinas Lingkungan Hidup dan Kehutanan Provinsi Gorontalo. (Tidak dipublikasikan)
- European Space Agency. 2021. Air pollution returning to pre-COVID levels. Diakses tanggal 30 April 2021. [https://www.esa.int/Applications/Observing\\_the\\_Earth/Copernicus/Sentinel5P/Air\\_pollution\\_returning\\_to\\_pre-COVID\\_levels](https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel5P/Air_pollution_returning_to_pre-COVID_levels)
- Food and Agricultural Organization (FAO). 2020. Impact of COVID-19 on agriculture, food systems and rural livelihoods in Eastern Africa: Policy and programmatic options. Accra. <https://doi.org/10.4060/cb0552en>
- Guan, D., D. Wang, S. Hallegatte, S.J. Davis, S. Huo, L. Li, Y. Bai, T. Lei, Q. Xue, D. Coffman, D. Cheng, P. Chen, X. Liang, B. Xu, X. Lu, S. Wang, K. Hubacek, P. Gong 2020, *Global supply-chain effects of COVID-19 control measures* *Nat. Hum. Behav.* [10.1038/s41562-020-0896-8](https://doi.org/10.1038/s41562-020-0896-8)

- Huang, C., Wang, Y., Li, X., Ren, L., Zhao, Z., Hu, Y. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395: 497–506. doi:[10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5)
- International Energy Agency (IEA) (2020). Global Energy Review. <https://www.iea.org/reports/global-energy-review-2020> Date accessed: 21st April 2021
- International Monetary Fund. (2020) World economic outlook: A long and difficult ascent, IMF, Washington, DC, October 2020
- Jiang, P., Fu, X., Fan, Y. V., Klemeš, J. J., Chen, P., Ma, S., & Zhang, W. (2021). Spatial-temporal potential exposure risk analytics and urban sustainability impacts related to COVID-19 mitigation: A perspective from car mobility behaviour. *Journal of cleaner production*, 279, 123673. <https://doi.org/10.1016/j.jclepro.2020.123673>
- Jonarsi, L. 2020. Dampak merebaknya pandemi Covid-19 terhadap lingkungan
- Karunathilake, K. (2020). Positive and negative impacts of COVID-19, an analysis with special reference to challenges on the supply chain in South Asian countries. *J. Soc. Econ. Dev.* (2020). <https://doi.org/10.1007/s40847-020-00107-z>
- Lal, R. 2020. Soil Science Beyond Covid-19. *Journal of Soil and Water Conservation* April 2020, jswc.2020.0408A; DOI: <https://doi.org/10.2489/jswc.2020.0408A>
- Leal Filho, W., Brandli, L. L., Lange Salvia, A., Rayman-Bacchus, L., & Platje, J. (2020). COVID-19 and the UN Sustainable Development Goals: Threat to Solidarity or an Opportunity? *Sustainability*, 12(13), 5343. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/su12135343>
- Kacaribu, F. (2020). Media briefing: program pemulihan ekonomi nasional. Materi Kepala Badan Kebijakan Fiskal Kementerian Keuangan RI. Diakses tanggal 29 April 2021, <https://www.kemenkeu.go.id/media/15116/media-briefing-kabkf.pdf>
- Masinambow, B.W.L., Gosal, PH., (2020). Tantangan dan peluang dunia jasa konstruksi di tengah pandemic Covid-19. *Jurnal Media Matrasain* Vol.17 No.1 Maret 2020, Hal.9-14 P-ISSN: 1858-1137, E-ISSN: 2723-1720. <https://ejournal.unsrat.ac.id/index.php/jmm>
- Mofijur, M., Rizwanul FIM., Asraful Alam, Md., Saiful Islam, A.B.M., Hwai Chyuan Ong, S.M. Ashrafur Rahman, G. Najafi, S.F. Ahmed, Md. Alhaz Uddin, T.M.I. Mahlia (2021). Impact of COVID-19 on the social, economic, environmental and energy domains: Lessons learnt from a global pandemic. *Sustain Prod Consum.* 2021 Apr; 26: 343–359. Published online 2020 Oct 14. doi: 10.1016/j.spc.2020.10.016
- Paramo, CS. 2020. COVID-19 will hit the poor hardest. Here's what we can do about it
- Pulubuhu, D.A.T., Unde, A.A., Sumartias, S., Sudarmo., and Seniwati. (2020). The Economic Impact of COVID-19 Outbreak on the Agriculture Sector. *Int. J. Agr. Syst.* 8(1):57-63. <http://pasca.unhas.ac.id/ojs/index.php/ijas/article/view/2337>
- Pol, E. 2019. Is Low Protein Wheat a Symptom of Low Soil Organic Matter? GRDC Communities.. Available online: <https://communities.grdc.com.au/crop-nutrition/low-protein-wheat-symptom-low-soil-organic-matter/> (accessed on 22 March 2021)
- Rahman, D.F., 2020 Agriculture resilient to pandemic's impact. This article was published in <https://www.thejakartapost.com/news/2020/08/08/agriculture-resilient-to-pandemics-impact.html>.

- Reid, G., O'Beirne, N., Gibson, N. (2020). *How companies can reshape results and plan for a COVID-19 recovery* [https://www.ey.com/en\\_ie/transactions/companies-can-reshape-results-and-plan-for-covid-19-recovery](https://www.ey.com/en_ie/transactions/companies-can-reshape-results-and-plan-for-covid-19-recovery)
- Rowan, N., Laffey J.G., (2020). *Challenges and solutions for addressing critical shortage of supply chain for personal and protective equipment (PPE) arising from Coronavirus disease (COVID19) pandemic – case study from the Republic of Ireland* Sci. Total Environ., 725 (2020), [10.1016/j.scitotenv.2020.138532](https://doi.org/10.1016/j.scitotenv.2020.138532)
- Satgas Covid-19 Provinsi Gorontalo. 2021. <https://dinkes.gorontaloprov.go.id/covid-19/> . Diakses 29 April 2021
- Tripathy, A., Tyagi, V.K., Vivekanand, V., Bose, P., Suthar, S., (2020). *Challenges, opportunities and progress in solid waste management during Covid-19 pandemic*. Case Studies in Chemical and Environmental Engineering Volume 2, September 2020. <https://doi.org/10.1016/j.cscee.2020.100060>
- UNICEF. 2021. The impact of COVID-19 on child poverty and mobility in Indonesia. Policy Brief: diakses tanggal 28 April 2021: <https://www.unicef.org/indonesia/media/8456/file/The%20impact%20of%20COVID-19%20on%20child%20poverty%20and%20mobility%20in%20Indonesia.pdf>
- Zambrano-Monserrate, MA., María Alejandra Ruano, Luis Sanchez-Alcalde, 2020. *Indirect effects of COVID-19 on the environment*. Sci Total Environ. 2020 Aug 1; 728: 138813. Published online 2020 Apr 20. doi:10.1016/j.scitotenv.2020.138813
- Wu, YC., Chen, CS., Chan, YJ. (2020). The outbreak of COVID-19: An overview, Journal of the Chinese Medical Association: March 2020 - Volume 83 - Issue 3 - p 217-220 doi:10.1097/JCMA.0000000000000270
- Wuryandani, D. 2020. The Covid-19 impact on Indonesia economic growth 2020 and the solution. A brief study of actual and strategic issues. Economic and public policy. Vol.XII., No. 15/I/Puslit/August/2020. Research Center Expertise Agency of DPR RI
- Web Soil Survey. 2020. Suitabilities and Limitations for Use; Disaster Recovery Planning; Catastrophic Mortality, Large Animal Disposal, Trench. Available online: <http://websoilsurvey.nrcs.usda.gov> (accessed on 21 March 2021)
- Wood, S.A.; Tiffessa, D.; Baudron, F. 2018. Soil organic matter underlies crop nutritional quality and productivity in smallholder agriculture. Agric. Ecosyst. Environ. 2018, 266, 100–108. <https://www.sciencedirect.com/science/article/abs/pii/S0167880918303025?via%3Dihub> (Accessed on 25 March 2021)
- Worldmeter. 2021. <https://www.worldometers.info/coronavirus/> . Diakses tanggal 29 April 2021
- Xiaorong W., Zhou, Q., He, Y., Liu, L., Ma, X., Wei, X., Jiang, N., Liang, L, Zheng, Y., Ma, L., Xu, Y., Yang, D., Zhang, J., Yang, B., Jiang, N., Deng, T., Zhai, B., Gao, Y., Liu, W., Bai, X., Pan, T., Wang, G., Chang, Y., Zhang, Z., Shi, H., Ma, WL., Gao, Z. 2020 Nosocomial outbreak of COVID-19 pneumonia in Wuhan, China. European Respiratory Journal Jun 2020, 55 (6) 2000544; DOI: 10.1183/13993003.00544-2020