Climate Change

by Guntur Pamungkas

LAND USE, LAND COVER AND CLIMATE CHANGE IN COASTAL AREA: EVIDENCE AT JAYAPURA CITY, PAPUA PROVINCE, INDONESIA

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Abstract: This study aims to analyze land use and land cover change (LULCC) that affect climate change, especially in the coastal areas of Jayapura City as well as disaster mitigation strategies for vulnerabilities caused later in life. The method used is to identify land use movements with the spatio-temporal method and strategies for handling climate change vulnerability in the coastal areas of Jayapura City. The geospatial process is carried out for environmental aspects that implement that in the Jayapura city area has a significant decrease in vegetation ranging from 67.28% or 29.875,904 ha. This shows the category as a deforestation area that poses a vulnerable area from the impacts of coastal climate change in Jayapura City. In such vulnerabilities it is necessary to take preventive measures such as reforestation or even afforestation that serve for proper and continuous monitoring. As in this coastal area, it is hoped that it will always have a maintained ecosystem balance in order to realize the sustainability of the local environment in the future.

Keywords: spatio-temporal, land use and land cover change (LULCC), climate change, disaster mitigation, reforestation, afforestation

Introduction

In the global era, especially regions that have diverse landscapes, there are risks to land changes (Näschen et al., 2019). This risk arises in various tropical areas, especially in the coastal areas of Jayapura City. Land change is a phenomenon that can be affected by climate change that has occurred in the last period of time. According to (Santos et al., 2021) with the definition of derivatives of the impacts of climate change, one of which is deforestation of about 8%. Deforestation is also a major factor in the world's spotlight related to the reduction of green land (Giam, 2017). This has a huge impact on local climate change. Because these environmental phenomena such as changes in land use and cover, deforestation and climate change become one continuity that will have a serious impact on ecosystems.

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According to the Intergovernmental Panel on Climate Change (IPCC) in (Shukla et al., 2019) suggests that climate change can be linked to changes in land use and cover such as deforestation, decentralization, land degradation and so on. So that this affects the stability of the environment in coastal areas, especially Jayapura City. According to (Sippo et al., 2018), mangroves are spearheading as a type of plant that can regulate environmental balance, especially in coastal areas. The reduction of this area poses a threat to biodiversity along the coast of Jayapura City. These impacts are the focus of this study so that potential strategies can be formulated to prevent this type of vulnerability. Although previous studies have conveyed climate change, it has not been correlated with deforestation that is increasingly rampant. Therefore, this study contributes to resilience to the threats posed as an implementation in the coastal area of Jayapura City, Papua Province, Indonesia. The purpose of this study is to identify threats that will arise as a result of land change, especially the reduction of vegetation in the last 5 years.

Research Method

This research study area covers all areas in Jayapura City. In figure 1, it shows the total area of Jayapura City is 75,819,854 ha with Muara Tami District as the largest district which has a coverage of 43,351,232 ha. Because evenly the jayapura city area can be categorized as a coastal area (Hamuna et al., 2018). So that it can become a center for the development of ecosystems based on natural resources and the environment in a sustainable manner.
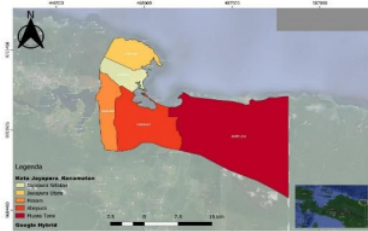

Figure 1. Administration Map of Jayapura City

Climate Change is closely related to various factors that are on the coast (Gething & Puckett, 2019). Therefore, this phenomenon can be correlated with changes in land use and cover that have many impacts such as in Jayapura City. The survival of marine life as food and livelihoods for residents around the sea is the main focus in developing strategies based on natural resources and the environment to reduce future threats and vulnerabilities. In addition, the ocean can be harnessed to produce renewable "blue energy," such as wind power, waves, heat, and biomass (Cavagnaro et al., 2020).

This research focuses on monitoring aspects in coastal areas where the concept of disaster mitigation must be considered (Dechezleprêtre et al., 2020). In this case, the study uses geospatial techniques related to changes in land use and cover with the spatio-temporal method in 2017 and 2022. Disaster mitigation is the basis of developing coastal resilience strategies based on natural resources and the environment that have been implemented by various countries in the world (Howard et al., 2017). The principles in this

concept become the foundation of sustainable development by making balanced use of natural resources and conservation of coastal areas (Rahman et al., 2022).

Source: USGS, 2022

Figure 2. Landsat-8 OLI TIRS Data for Jayapura City area 2017 and 2022

In figure 2. shows secondary data used to analyze these in land use and cover change. Landsat-8 OLI TIRS imagery of USGS products taken in 2017 and 2022. First image processing was carried out, namely geometric and radiometric corrections (Leroux et al., 2018). Second, this Image Product was previously verified by the image checking method using a basemap such as google hybrid (Correia et al., 2018). Then, the third validation is carried out with the Virtual Building Tools method and the Dzetzaka Plugin in other words can be mentioned with the term Semi-Automatic Classification Tools (Congedo, 2021). By using QGIS 3.22.4 with combination of bands 7, 6, and 4 (R,G,B) to display the results of the imagery according to the characteristics of each band. Table 1. are the characteristics of each band of Citra Landsat-8 OLI-TIRS products.

Table 1. Spektral Data Characteristics of Landsat-8 OLI-TIRS

Band Number	Description	Wave Length	Resolution
Band 1	Coastal/Aerosol	0.433-0.453 µm	30 Meters
Band 2	Visible Blue	0.450-0.515 µm	30 Meters
Band 3	Visible Green	0.525-0.600 µm	30 Meters
Band 4	Visible Red	0.630-0.680 µm	30 Meters
Band 5	Near-Infrared	0.845-0.885 µm	30 Meters
Band 6	Short Wavelength Infrared	1.56-1.66 µm	30 Meters
Band 7	Short Wavelength Infrared	2.10-2.30 µm	60 Meters
Band 8	Panchromatic	0.50-0.68 µm	15 Meters
Band 9	Cirrus	1.36-1.39 µm	30 Meters
Band 10	Long Wavelength Infrared	10.3-11.3 µm	100 Meters
Band 11	Long Wavelength Infrared	11.5-12.5 µm	100 Meters

Source: USGS, 2022

To find out the Semi-Automatic Classification method using the dzetzaka plugin in QGIS 3.22.4, you can see the flow chart listed in The Figure 3:
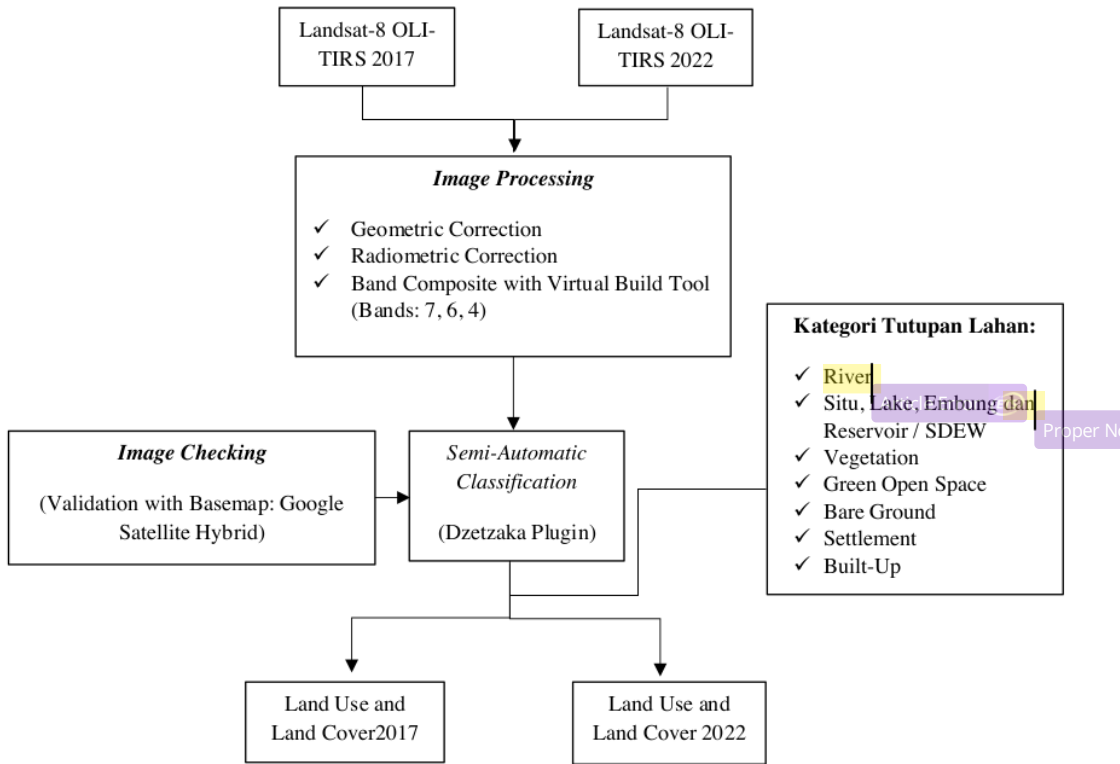

Figure 3. Flowchart of Remote Sensing Methods with QGIS 3.22.4

Results and Discussion

Jayapura is an area located on the coast of Papua Island, so that objects in Jayapura City are dominated by beautiful and exotic beaches (Hébert et al., 2020). Several beaches on the coast of Jayapura City that have natural resources and the environment and are recommendations in the conservation of marine life seen in Figure 4, include:

1. Base G Beach, located in Tanjung Ria Village, North Jayapura District.
2. Kupang Beach, located right in front of the Papua Governor's Office. This tourist spot is called Kupang Beach because it is synonymous with the existence of long concrete benches.
3. Hamadi Beach, located in the South Jayapura District or about 15 minutes from the Axis of Government of Papua Province.
4. Cibery Beach, located in the South Jayapura District, precisely in the Youtefa Bay Area. The beach is also located just below the Youtefa Bridge

5. Holtekamp Beach, located on the territory of muara Tami District.
6. Yacoba Beach, located in South Jayapura District.

Figure 4. Geo-Spread Map of The Beach in Jayapura City, Papua Province, Indonesia
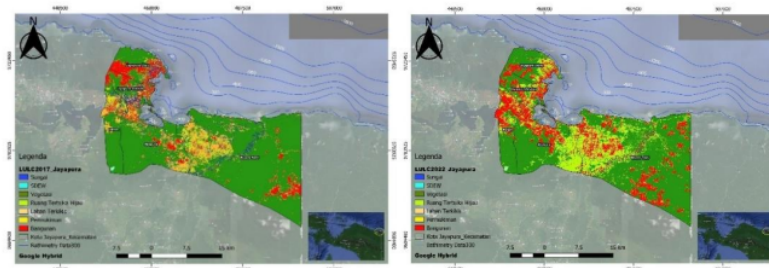
Figure 5. LULCC Maps of Jayapura City 2017-2022

In Figure 3. shows a significant change in land cover with general categories, such as water bodies (River, Situ, lakes, embung, and reservoirs), vegetation, green open space, bare ground, settlements and built-up (Sejati et al., 2019). The results of this study identified categories in the form of land cover listed in Table 4. That in 2017-2022 has a drastically decreased vegetation area namely . This is a deforestation phenomenon that can cause climate change, especially in coastal areas because there are various types of biota that are very dependent on forest areas as their habitats. (Pham et al., 2019).

Table 2. LULC Area of Jayapura City 2017 and 2022

LULC	Area 2017 (ha)	Area 2022 (ha)
Sungai	77.973	155.352
SDEW	71.497	104.103
Vegetasi	44402.7	14526.796
Ruang Terbuka Hijau	27128.58	45227.48
Lahan Terkikis	698.425	250.586
Permukiman	1095.189	1359.452
Bangunan Lain	2345.49	14196.085
Total Keseluruhan	*75819.854*	*75819.854*

In Figure 4. displaying a fluctuating graph of the visualization results of Table 4. Buildings and settlements are focusing in this study, because they are enough to contribute to the decrease in vegetation area, which is 67.28% or 29,875,904. Because this can adversely affect climate change, it is necessary to identify accurate strategies that can be prioritized to prevent vulnerabilities that will occur (Anderson et al., 2020).
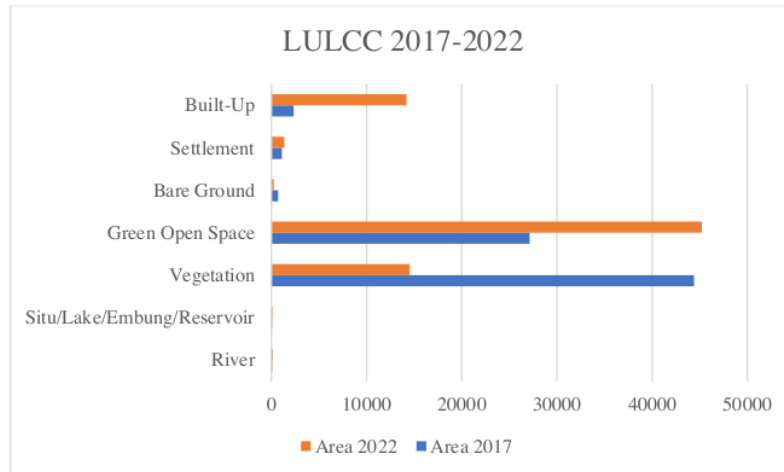
Figure 4. Graphic of Land Use and Land Cover Change in Jayapura City 2017-2022

The coastal area of Jayapura City contains a source of life that is suitable for marine life to inhabit, with changes in the use and cover of the land, efforts are needed to prevent threats and vulnerabilities that arise due to natural factors (Pamungkas, 2021).

The strategy that can be put forward in this study is that as stated in the Paris Climate Agreement, efforts are needed to create resilience in the form of reforestation and even afforestation (Azahro & Ardi, 2017). In addition, local communities also need to adapt to vulnerabilities that arise significantly. The decrease in land area can also be affected by sea level rise, this is also a threat caused by climate change (Rahmani et al., 2021). Replanting by degraded land or re-establishment of forests from land that is not a forest area is very important in increasing this resilience that must be implemented by the local government.

Conclusion

Land in Jayapura City has changed in the last 5 years. Natural resources and the local environment need to be improved by conserving forest areas, especially for mangrove plants so as to prevent threats and vulnerabilities caused. The Jayapura City Government also needs to include tribes in Papua known as the Local Customary Law Community (MHAP). The government and coastal communities are expected to unite in participating in preserving ecosystems for the survival of biota and creatures living in marine space. For its sustainability, it can be minimized the exploitation of marine products so as to create an area based on the blue economy.

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