

## Spatiotemporal for Sea Reclamation in Makassar City Coastline, South Sulawesi: Best Solution or Environmental Impact?

### INTRODUCTION

Urbanization had a major impact on a country causing rapid changes in land cover (Gaw and Richards 2021). Urban expansion certainly has an impact on the surrounding non-building areas. The effects of economic growth are also felt and this accelerates the change of vegetation areas into densely populated settlements (Surya et al. 2021). Including peri-urban

areas, agricultural areas are not spared from expansive and destructive land use. This is a phenomenon that is often found in every country. Particularly in Indonesia, urban expansion has mushroomed in various big cities.

The city of Makassar is the largest city on the island of Sulawesi and is also included in the eastern Indonesian region which has not escaped the phenomenon of urban expansion. A special phenomenon of converting seawater cover into a built-

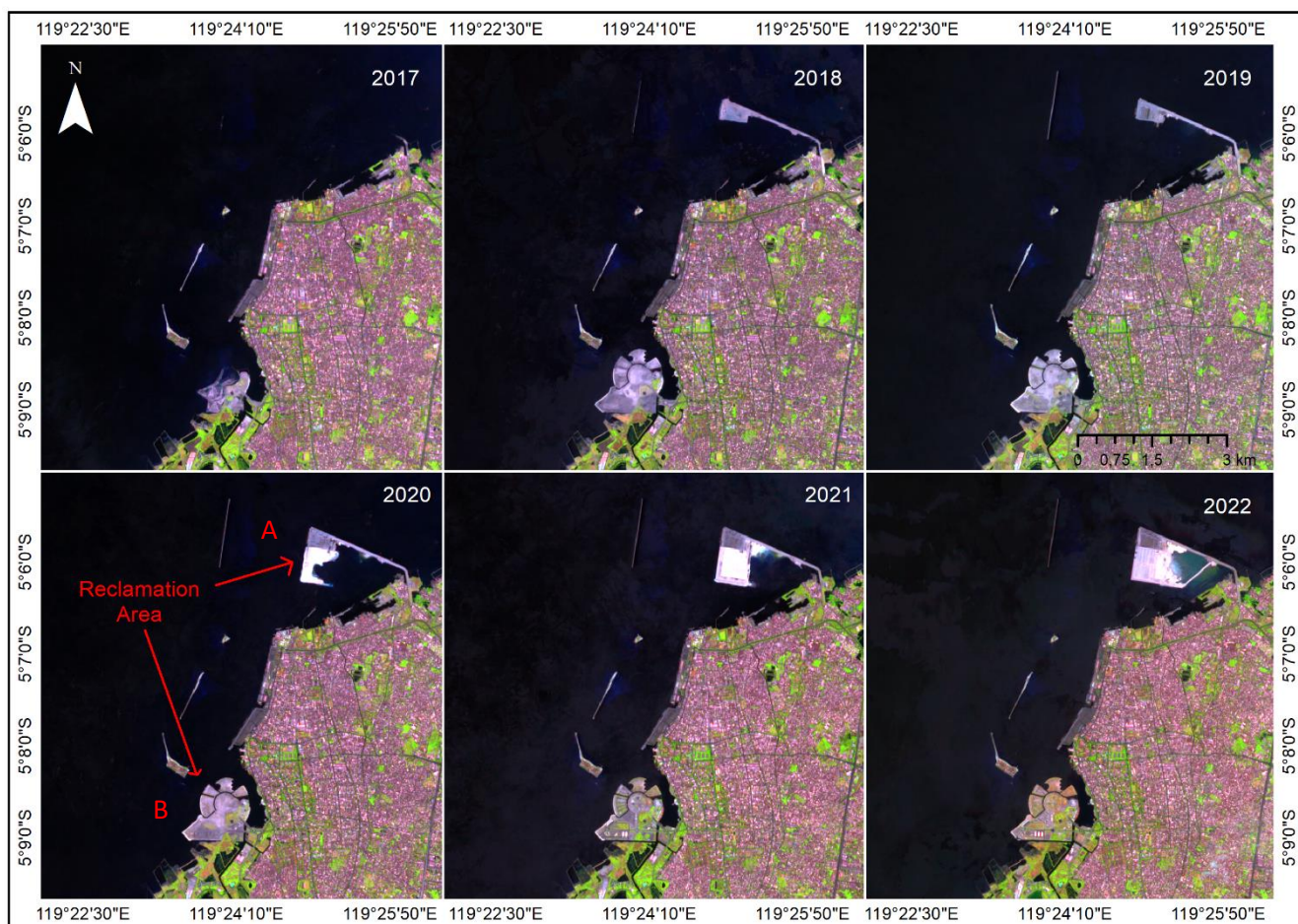


Figure 1. Spatial for sea reclamation

up area also occurs in this area. This phenomenon is caused by limited access to land and the high price of land in urban areas (Duan et al. 2016). Of course, this is a new thing experienced by the patterns and strategies for developing cities in Indonesia. In this short data article, we try to provide spatially based information about the development of sea reclamation on the coast of Sulawesi Island, especially in Makassar City.

## DATA & INFORMATION

### *Spatiotemporal Sea Reclamation*

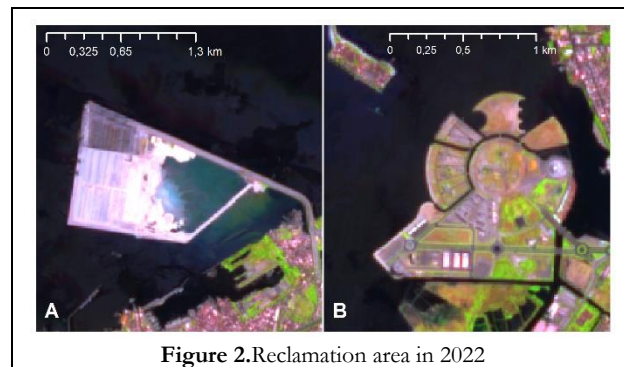
This spatial information is the result of interpretation from remote sensing data, namely satellite imagery. The image used is Sentinel-2 MSI (MultiSpectral Instrument) which has a moderate type of spatial resolution. This is an observation satellite belonging to ESA (European Space Agency) in the Copernicus program and this satellite was launched on June 23, 2015. Even though it has low resolution, this image is also very useful and is often used in monitoring the earth's surface. In addition, the open-source status of this satellite is the best opportunity for users. Especially in the case of ocean reclamation, there have been several previous studies using this image. For example, in the research of Ai et al. (2022) involving Sentinel imagery and comparing it with Landsat imagery in monitoring sea reclamation in Guangdong Province, China.

**Table 1.** Sentinel-2 specification

No	Index	Resolution (m)
B1	Coastal aerosols	60
B2	Blue	10
B3	Green	10
B4	red	10
B5	Red-edge 1 (RE1)	20
B6	Red-edge 2 (RE2)	20
B7	Red-edge	20
B8	Near infrared (NIR)	10
B8a	Narrow near infrared (NIRn)	20
B9	Water vapor	60
B10	Shortwave infrared/Cirrus	60
B11	Shortwave infrared 1 (SWIR1)	20
B12	Shortwave infrared 2 (SWIR2)	20

This geospatial data analysis was carried out using the GEE (Google Earth Engine) cloud computing platform launched by Google in this decade. There are several advantages possessed by the monitoring model using GEE. Selection of the best pixel-based imagery is

applied to this platform, resulting in the best remote sensing data extraction results. In addition, this is also done to minimize atmospheric effects that can interfere with the visualization of land reclamation information.



**Figure 2.** Reclamation area in 2022

The results of this brief monitoring show that there has been reclamation activity from 2017 to the present (Figure 1). Two areas are the focus of reclamation on the coast of Makassar City, namely the northern and southern parts. The northern part of the reclamation is a national project owned by the Indonesian government in the development of the Makassar New Port (Figure 2: part A). While the southern part is an area of mosque construction an area open to the public (Figure 2: part B). Spatiotemporally, Figure 1 shows that the construction of the mosque area (Figure 2: part B) is faster than the port area (Figure 2: part A). Also in the mosque construction area, satellite imagery has succeeded in detecting vegetation areas (since 2018) and has been distributed until 2022. The spatiotemporal-based spatial distribution in the case of the reclamation area is very useful for the local government in monitoring the area. Users can also fully access remote sensing data based on open sources so that they can reduce the operational costs of monitoring reclamation areas. According to Ai et al. (2022), the results of this monitoring can also be used as the main supporting data for decision making in coastal management and conservation.

### *Makassar City Coastal Ocean Reclamation: Progress, Impact and Recommendations*

In general, from various cases in the world, the development of reclamation areas has two functions, namely the allocation of new settlements and the development of public infrastructure. As is the case in China, the local government carries out reclamation in

various areas with the aim of expanding ports and new ports as well as housing and recreational areas (Duan et al. 2016). Meanwhile in Singapore, around 15% of Singapore's territory is a sea reclamation area and is used for urban and industrial development (Zhang et al. 2017). The case of the development of the sea reclamation area in Makassar City is an effort by the local government to build public areas and port infrastructure. According to data from The Committee for Acceleration of Priority Infrastructure Delivery (KPPIP), This port infrastructure is planned to be built in 2015 and has a capacity of 500,000 CBUs (KPPIP 2023). This port infrastructure is a container port owned by PT Pelindo Terminal Petikemas which can serve the loading and unloading of goods from ships that stop in Makassar City. This is a strategic effort in accelerating the development of the city. It is known that port infrastructure is very important and has an impact on the speed of movement of goods and people between regions.

In contrast to the reclamation that occurred in the south and functioned as an area open to the public. In Figure 1, beach reclamation has been completed since 2018, and then the infrastructure development stage on the reclamation land. This is a twin tower development program in Center Point Indonesia (CPI) and is owned by a local government company, South Sulawesi Province. One of them is the grandest mosque on the coast of Makassar, namely The 99 Domes Mosque which is an area accessible to the public. This case also occurs in China by reclaiming beaches so that it can add space for the development of tourism infrastructure (Duan et al. 2016). In contrast to the country of Singapore, the case of the reclamation area has become accessible to new settlements for residents (Gaw and Richards 2021). This also happened in Indonesia.

Apart from having a good impact on the economic cycle, environmental and social impacts are issues that often surround this project. Duan et al. (2016) and Wang et al. (2014) explained the impacts that generally occur as a result of ocean reclamation, namely ecosystem damage and geological disasters, decreased diversity of bird and fish species around the coast, and decreased quality of the marine environment due to air, water, soil, and sediment pollution. This happened in the case of the Jakarta Bay reclamation which removed and damaged the mangrove ecosystem so that it affected the absorption of pre-existing greenhouse gas

emissions (Slamet et al. 2020). In terms of social impact, the low economic group is the most vulnerable group to be affected by this large project. Dependence on natural products, for example, fishermen around the reclamation area will experience difficulty accessing and even lose the area where they live. This is homework that must be immediately given a solution by the local government, especially the government of Makassar City.

In terms of urban development, the next challenge is how to manage the area on an ecological basis. Plastic waste is a problem that generally affects big cities in the world, especially in Indonesia, including Makassar City. This has happened in the city of Jakarta, where the river continuously carries waste to the coast of Jakarta (Padawangi 2012). Control of impacts in urban areas and greening of areas is an action that must be implemented by the area manager. Apart from that, it is very important to educate the people around the reclamation area on an ecological basis, especially low-income people. According to Azwar et al. (2013) that this factor should be the main concern of the government in planning and developing the concept of an ecological city.

## CONCLUSIONS

Remote sensing data has succeeded in revealing the reclamation area from 2017 – 2022 on the coast of Makassar City. MSI's Sentinel-2 capabilities can be used as a recommendation for using the best open source-based imagery in monitoring ocean reclamation areas. This helps the local government control the area so that it can reduce the environmental and social impacts around the ocean reclamation area.

## References

- Ai B, Huang K, Zhao J, Sun S, Jian Z, Liu X. **2022**. Comparison of classification algorithms for detecting typical coastal reclamation in Guangdong Province with Landsat 8 and Sentinel 2 images. *Remote Sensing*. 14(2): 385. <https://doi.org/10.3390/rs14020385>
- Azwar SA, Suganda E, Tjiptoherijanto P, Rahmayanti H. **2013**. Model of sustainable urban infrastructure at coastal reclamation of North Jakarta. *Procedia Environmental Sciences*. 17: 452-461. <https://doi.org/10.1016/j.proenv.2013.02.059>
- Duan H, Zhang H, Huang Q, Zhang Y, Hu M, Niu Y, Zhu J. **2016**. Characterization and environmental impact analysis of sea land reclamation activities in China. *Ocean and Coastal*

- Management. 130: 128-137. <https://doi.org/10.1016/j.ocecoaman.2016.06.006>
- Gaw LYF, Richards DR. **2021**. Development of spontaneous vegetation on reclaimed land in Singapore measured by NDVI. *plos one*. 16(1): 0245220. <https://doi.org/10.1016/j.ocecoaman.2014.03.009>
- Slamet NS, Dargusch P, Aziz AA, Wadley D. **2020**. Mangrove vulnerability and potential carbon stock loss from land reclamation in Jakarta Bay, Indonesia. *Ocean and Coastal Management*. 195:105283. <https://doi.org/10.1016/j.ocecoaman.2020.105283>
- Surya B, Salim A, Hernita H, Suriani S, Menne F, Rasyidi ES. **2021**. Land use change, urban agglomeration, and urban sprawl: a sustainable development perspective from Makassar City, Indonesia. *Land*. 10(6): 556. <https://doi.org/10.3390/land10060556>
- Padawangi R. **2012**. Chapter 13 climate change and the north coast of Jakarta: environmental justice and the social construction of space in urban poor communities In *Urban Areas and Global Climate Change*. Emerald Publishing Limited. pp. 321-339. [http://dx.doi.org/10.1108/S1047-0042\(2012\)0000012016](http://dx.doi.org/10.1108/S1047-0042(2012)0000012016)
- Wang W, Liu H, Li Y, Su J. **2014**. Development and management of land reclamation in China. *Ocean and Coastal Management*. 102: 415-425. <https://doi.org/10.1016/j.ocecoaman.2014.03.009>
- Zhang J, Su F, Ding Z. **2017**. Sea reclamation status of countries around the South China Sea from 1975 to 2010. *Sustainability*. 9(6): 878. <http://dx.doi.org/10.3390/su9060878>

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