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Geospatial Intelligence for Land Defense the Nation's Capital

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Abstract

The design plan for the location of the Indonesian state capital in East Borneo has not considered the defense aspect. As the center of gravity (CoG), the capital city symbolizes state sovereignty. This study aims to create a state defense model for the location of the national capital using geospatial intelligence (GEOINT). The method used is descriptive quantitative. The primary data is survey and mapping results using drones, secondary data from aerial photographs and satellite imagery, and defense object data from social media. From the combination of the physical and socio-cultural data, a gap in defense was found, primarily if the attack occurred by land. So that additional defense is needed, especially land defense bordering Malaysia.

Keywords— Geospatial; Intelligence; land; Defense; Capital

INTRODUCTION

What makes a city a capital city? All capital cities share that it privileged them when faced with other cities within the same political system. They represent a larger political entity around them. The capital city also has a different social life and displays culture[3]. The country's capital is the centre of gravity (CoG). For countries experiencing domestic strife, the centre of gravity is the capital[4,5]. The nation's capital symbolizes the national ideology and aspirations of the country. The capital is the centre of political and economic power, so that it plays a vital role in the nation's life and state. Such an essential role of the state capital makes it obligatory to protect and maintain its existence[6].

The capital city is the centre of a country with primary status in the country's government determined by law. As the centre of government, the capital city generally functions as a centre of political and economic power. It plays a vital role in the nation's life and state[6]. The nation's capital is a popular and unique location compared to other places[7]. The country's recognition and uniqueness make a capital a magnet for people to inhabit it. This in the future raises various problems that become a negative effect of urban agglomeration.

Some of the nation's capital problems are population, pollution and migration, building materials, and decreasing forest cover, as is facing the Indian Capital, New Delhi [8]. Jakarta is Indonesia's primate city and the second largest urban agglomeration globally[9]. As the capital city of Indonesia, Jakarta also has various complex problems. Floods often hit Jakarta, paralyzing economic and government activities. An economy that is too centralized and only revolves around Jakarta has created the envy of some regions[6]. Jakarta is experiencing traffic congestion, environmental degradation such as air and water pollution, flooding, and land subsidence[10].

The decision taken to move to the capital city is a crucial issue. Several countries have decided to move their capitals to existing cities or build new ones. Examples of cities built to serve as

capital cities include Washington, Ottawa, New Delhi, Brasilia, and Canberra. The decision to create, build capital is not simple[11]. Must pay attention to various conditions that are happening in the world.

Indonesia, the largest archipelagic country in Southeast Asia, plans to move its capital city. The Indonesian government plans to relocate 1.5 million central government employees from Jakarta to Borneo by 2024[12]. This plan will undoubtedly have implications for changes in the country's defense strategy and design. Moreover, the country's capital relocation is not on one island but to another island with different geographical and demographic characteristics. Geographically, the capital city of Jakarta is protected from direct attacks by other countries because to the north is the island of Borneo, to the east is the island of Bali, to the west is the island of Sumatra. To the south, although it borders the Pacific Ocean, the capital is located to the north of the island of Java. So that this country's capital already has a natural defense.

Like other countries in Asia, Indonesia also experienced a period of colonialism from Europeans, such as the Portuguese and the Dutch. As explained by Schatz, most countries are trying to get rid of the trauma of colonialism by moving their former capitals made by the colonialists[13]. I formerly knew Jakarta itself as Batavia, founded by Vereenigde Oost Indische Compagnie (VOC) as an arm of the Dutch Government. This trading company built Batavia into the center of its colonial rule. They managed to control trade in Southeast Asia by taking advantage of the strategic geographical location of Batavia.

The rapidly changing strategic environment will always go hand in hand with the broader threat that harms the national defense[14]. Changes in geographical position will undoubtedly make the defense of the national capital will also change. We can divide the extent of threats into military threats, non-military threats, and hybrid threats, which are divided into two, namely real and unreal threats. The national defense will require mutual adjustment between military and non-military defense by strengthening deterrence against existing threats.

The technology that can counteract these sudden threats is geospatial intelligence. This technology can combine various intelligence, such as imagery intelligence (IMINT), human intelligence (HUMINT), and open-source intelligence (OSINT). Image data can be obtained from various sources that can be validated with various sources. It then provided the image data with earth coordinates and intelligence information.

Geospatial Intelligence (GEOINT) is the exploitation and analysis of geospatial imagery and information to describe, assess, and visually describe physical features and activities geographically referenced on earth[15]. The basic idea of what geospatial intelligence is (both process and product) can be found in these fictional and actual illustrations: GEOINT requires analyzing a situation and creating a product that: (a) is anticipatory–it deals with the future; (b) involves some human activity; (c) draws on knowledge of the Earth (its surface, whether on land or sea and the objects on or beneath that surface); and (d) provides an information advantage to someone who must decide[16].

Sloan, Maloney, and Robertson stated that Revolution in Military Affairs (RMA) was one of them by increasing the detection capability and visibility of the battlefield[17]. We use various methods of obtaining data in predicting the future by combining data to estimate the current state of an entity and evaluating the forces acting on the entity to indicate its future state[18].

To perform a regional analysis using the principle of image interpretation using interpretation elements when interpreting photos visually. Image interpretation elements include location, tone and color, size, shape, texture, pattern, shadow, height and depth, volume, slope, aspect (slope direction), site, situation, and association[19].

Tabel 1. *Areas of Interest dan Areas of Influence*[20]

Areas of Interest			*Areas of Influence*		
Level of Command	Time Beyond FLOT*	Distance Beyond FLOT* miles (Km)	Level of Command	Time Beyond FLOT*	Distance Beyond FLOT* Miles (Km)
Battalion	0-12 hours	9 (15)	Battalion	0-3 hours	9 (15)
Brigade	0-24 hours	43 (70)	Brigade	0-12 hours	43 (70)
Division	0-72 hours	93 (150)	Division	0-24 hours	93 (150)
Corps	0-96 hours	186 (300)	Corps	0-72 hours	186 (300)
Echelons above corps	96 + hours	621+ (1.000)+	Echelons above corps	72 + hours	621+ (1.000)+

ModelBuilder is a programming tool developed by Environmental Systems Research Institute (ESRI). First, the Shapefile is converted into a grid format, followed by several spatial buffering, classification, reclassification, and overlaying processes. Finally, assigning a weighting effect to each factor, a weighting is added to combine these factors as a weighting overlay process[21].

We have successfully used drone data as supplementary information with satellite data to detect changes in terrain behavior. Drone data is used here to train the neural network, which can be used on future data sets without further training. We can calculate field information precisely, which may be helpful for defense and civilian purposes. They have carried out the quantitative analysis in this research, which can be used for various applications such as in defense to plan troop movements, actual terrain scenarios, precision agriculture, etc[22].

This method can be applied in various levels of defense, both at the national level to the lowest regional level. It utilized the universal defense system that has become a reference in guerrilla warfare[23] by combining all the nation's power, known as the total war[2,24].

The use of remote sensing and photogrammetry applications is applied to various defense applications such as logistics planning in different terrain areas and identification of sizes suitable for movement, identification of enemy troop concentrations in certain regions. Multi-resolution mapping and informative path planning assist in unmanned aerial vehicle (UAV)-based terrain monitoring. The use of aerial images obtained by UAVs for object recognition is helpful for civil and defense purposes[22].

The main motive of this paper is to try to combine various spatial and non-spatial data with GEOINT to create a defense model for the new national capital on the island of Borneo. By applying the concept of Linear Defense and the Wehrkreise System ("independent military defense unit pocket") and ratified as "People's Defense Doctrine"[25]. Also known in the 2015 National Defense Doctrine as defense enclaves are called the Wehrkreise system (circular defense)[26].

The proposed technique is to buffer the defense elements on the island of Borneo. This technique uses the FLOT distance of each command (Table 1).

STUDY AREA AND DATA DESCRIPTION

Study Area

The area that will be used as the research area is the island of Borneo (Indonesian is Kalimantan) where the new location for the new candidate for the new Indonesian state capital (CoIS) will be made. The island of Borneo itself is located at 7° 1' 16,477" North Latitude - 4° 11' 3.690" South Latitude and 108° 47' 45,420" - 119° 17' 6,995" East Longitude. As for the area which is part of the state of Indonesia, it is at 4° 23' 39.148" North Latitude - 4° 8' 42,292" South Latitude and 108° 49' 58,016" E - 119° 1' 2,395" East Longitude. (source data .shp from https://www.naturalearthdata.com downloaded March 7, 2019).

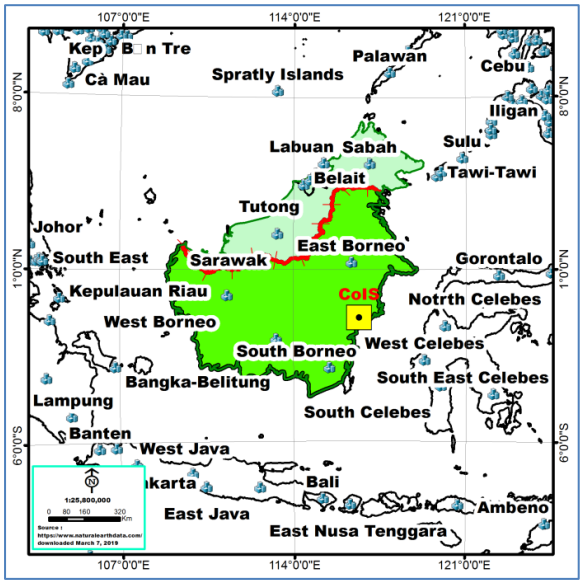

Figure 1. CoIS plan geographic location.

The land area of Borneo Island is 733,009 Km^2 with a land area including the territory of Indonesia, which is 531,864 Km^2. The circumference of the island is 7,252,694 km. It can be seen in Figure 1. This island is the third-largest in the world after Greenland and New Guinea and an enormous landmass in the Sundaic Region, more than five times the size of Java[27].

Data Description

Remote Sensing

Remote sensing is the science and art of obtaining information about an object, area, or phenomenon through data analysis obtained by using a tool without being directly related to the object, location, or phenomenon being investigated[28].

This study used remote sensing data used in the google maps and ArcGIS Pro applications. Google maps images are obtained from various sources that Google processes. Meanwhile, in this study, the image used by ArcGIS Pro is a worldview with a spatial resolution of 0.5 m.

Photogrammetry

Photogrammetry is defined as the art, science, and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring, and interpreting photographic imagesis[29].

The photogrammetric data used in this study came from aircraft, drones, and pocket cameras. Aerial photos used were taken using planes and drones. PT. IHM took the aerial photo in 2007 (PT. Itci Hutani Manunggal or A limited liability company in Indonesia) and in 2019 by the Geospatial Information Agency (in Indonesia is Badan Informasi Geospasial / BIG). Aerial photo was taken in 2020.

Positioning

This data collection aims to obtain coordinate data as x, y, and z (commonly known as elevation). The data collection is done by taking positioning data using measuring instruments, namely GPS Geodetic, connected to CORS, and GPS Navigation. Data will be used for the analysis of existing land cover.

Geospatial Intelligence Model

Process Buffer

Spatial analysis has three main elements. First, it includes cartographic modeling. It represented all data set as a map, and a map-based operation (or applying map algebra) generates a new map. For example, buffering is the operation of identifying all areas on a map within a certain distance from some spatial object such as a hospital clinic, well, or a linear feature such as a road. The overlay includes logical operations (.AND .; .OR .; .XOR.) and arithmetic operations (+; -; ×; /). Logical overlays are denoted by .AND. Identify areas on a map that simultaneously satisfy a set of conditions on two or more variables. The

arithmetic overlay operation sums the values of two or more area variables with area[30].

Modelbuilders

ModelBuilder is an application that you can use to create, edit, and manage models. A model is a workflow that compiles a sequence of geoprocessing tools, passing output from one instrument to another as input. ModelBuilder can also be thought of as a visual programming language for building workflows[31].

ModelBuilder is a programming tool developed by ESRI. First, the Shapefile is converted into a grid format, followed by several spatial buffering, classification, reclassification, and overlaying processes. Finally, assigning a weighting effect to each factor, a weighting is added to combine these factors as a weighting overlay process[21].

METHODOLOGY

The method used in this research is descriptive quantitative. The data was got by combining the OSINT and HUMINT methods with the help of GEOINT. It showed the research procedure in Figure 2.

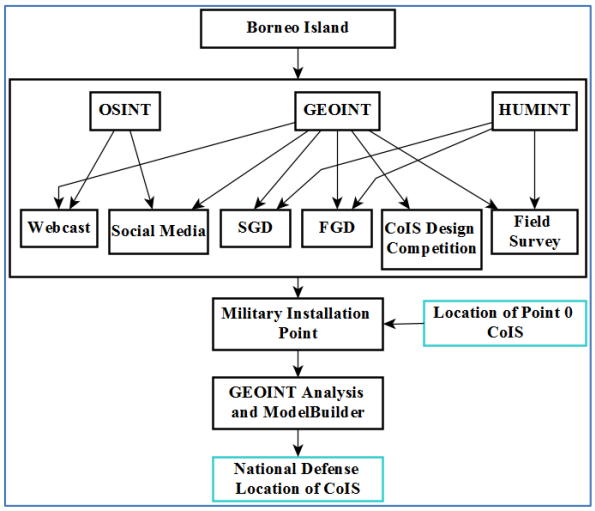

Figure 2. Research flowchart.

Data Collection

OSINT

An emerging data source is an open-source intelligence (OSINT), which often comes from unstructured data available on the internet or through other reporting mechanisms. Large swaths of geospatial data usually exist in silos because classified sensor data is handled differently from unclassified data to protect data, the sources, and methods of data collection. It is widely recognized that the percentage of data classified today is significantly lower than it was in the pre-internet era due to the pervasive and interchangeable nature of data and access today. The recent emergence of LEO payloads and the geospatial data provides many opportunities to integrate and combine sensors with non-sensor data[32].

OSINT is intelligence generated from publicly available information and collected, exploited, and disseminated on time to the right audience to meet specific intelligence needs. In addition, the law shows that "open source intelligence production is a valuable intelligence discipline that must be integrated into the task of intelligence collection, processing, exploitation, and dissemination to ensure that United States policymakers are well informed and fully informed[33].

According to Sands, OSINT can be divided into four major categories: widely available data and information; targeted commercial data; individual experts; and “gray” literature (access is possible but restricted to certain audiences). From these four categories, we can collect information from among others: - mass media: newspapers, magazines, radio, television; - public data: information got from government reports; official data, such as budget and demographic data; hearings; legislative debate; press conferences, speeches, and other public sources; - gray literature: open-source material customarily made available through controlled access to a specific audience. Materials in gray literature cover scientific, political, socioeconomic, and military disciplines (e.g., research reports, technical reports, unofficial government documents, working papers, discussion papers, preprints, studies, dissertations, and theses, etc.); - observation and reporting: important, unavailable information provided by, for example, amateur aircraft reconnaissance, radio monitors and satellite observers[33].

HUMINT

Human Intelligence (HUMINT) is a source of information obtained for a longer time. Compared to other intelligence sources, this

data source requires patience and tenacity in getting it. On the one hand, there is a need for proper training of intelligence officers and their mastery of working with human resources. On the other hand, acquiring a valuable resource of human intelligence is a highly complex operation that may take years and the ultimate success on many factors[33].

GEOINT

Imagery Intelligence (IMINT) is a term used to describe the intelligence function of geospatial sources. In the literature on this subject matter, time is still used interchangeably with GEOINT. However, in the opinion of many experts, this approach is wrong because the term IMINT is outdated and doesn't reflect what GEOINT is today. Currently, IMINT is part of GEOINT in image acquisition that uses, among others, visual photography, radar sensors, infrared sensors, lasers, and electro-optics. Thus, Image Intelligence is technical, geographic and intelligence information obtained from the interpretation or analysis of images and supplementary materials[33].

GEOINT, on the other hand, is a broader concept, also encompassing Geospatial Information, i.e., "information that identifies the geographic location and characteristics of natural or constructed features and boundaries on earth and includes: statistical data and information derived from, among other things: others, remote sensing, mapping, and surveying technologies; and mapping, charting, geodetic data, and related products". GEOINT also uses a Geographic Information System (GIS) to enter, collect, process, and disseminate data that has been successfully processed.

GEOINT will bridge the various data used as a reference for decision-making by the leadership. In terms of defense, GEOINT data is vital in maintaining the sustainability of a country to continue to exist in the Indo-Pacific region, which is a struggle for hegemony between the United States and China. These two great powers have certainly carried out various secret activities to explore each other's defense capabilities.

As the largest country in Southeast Asia, Indonesia has a vital role in maintaining regional peace. However, with the plan to move the capital from Java to Borneo Island, it will undoubtedly affect the defense and security of the Indonesian state. So this study seeks to create a defense model, especially land defense, on the island of Borneo.

Data Processing

OSINT

In this study, the data produced by various media were then carried out by providing georeference. This process involves the application Mapsource, google maps, and ArcGIS Pro. I then combined these three data sources to complement each other's shortcomings. The data in one application may be different, so it takes diligence and caution in interpreting the information received.

HUMINT

The data processing process involves data from various informants in the field. Researchers conducted direct interviews to obtain information behind the images obtained. This information will enrich the understanding of the past conditions of the location. These informants have lived in the CoIS planned site for a long time, so they know field conditions. This information is beneficial in assessing the feasibility and gaining knowledge regarding the disaster cycle at the CoIS plan site.

The CoIS design has indeed been made but does not retain information directly from the public. The plan relies too much on the satellite image and vector data, lacking accurate field information. Designers do not understand local wisdom so that the resulting design has shortcomings.

GEOINT

To get an up-to-date picture of the research area, it is necessary to have equipment with data available at all times. Satellite data retrieval costs a lot for high resolution and up to date. It would be inefficient to buy data through a vendor for a relatively small research area. For this reason, in this study, remote sensing data were collected using drones. Besides being cheap, data acquisition with drones also has a high resolution due to the relatively low flying height. Drone data acquisition can also be made

randomly if you already have secondary data with the same relative resolution.

Several agencies, both international and national, provide free geospatial data. The USGS site, for example, provides services after registration with the facility of downloading Digital Elevation Model (DEM) images and Landsat and Sentinel satellite images. Meanwhile, the BIG website offers services for downloading vector data (Rupa Bumi Indonesia) and raster data in the form of DEMNAS (DEM *Nasional*). Some data is also obtained through the googlemaps site, which provides geospatial information in vectors and raster. Figure 3(a).

ESRI provides an online application that can retrieve geospatial intelligence data. ArcGIS Pro makes it easy for researchers to download available raster and vector data for free. In addition, using CityEngine makes it easy to retrieve data in .shp format as urban area infrastructures such as Astana, Putrajaya, Brasilia, and the COIS location plan area. In ArcGIS Pro, it can download several data options, especially raster data in the form of imagery, hybrid imagery, Streets, and other forms.

Current technological advances, especially mobile phones with digital cameras, make it easier to take field photos. Another advantage is that many providers provide android applications equipped with georeferences and location information. In this study, images were taken using the Timestamp Camera application. This application includes information on the coordinates and location information of the research object taken along with the time and date of collection. Figure 3(b).

The primary data in positioning is generated by taking x, y, and z coordinates using GPS Geodetic with the help of GPS Navigation data. Geodetic GPS uses the South Galaxy G6 type L2 brand, connected to INACORS, which is on the coast of the Balikpapan area. Figure 3(c).

The results of remote sensing data processing such as Aerial photos taken by drones during the research. Data collection was carried out from December 6 to December 29, 2020. The acquisition results produce raster (photo) and vector (Digital Surface Model/DSM) data. From several acquisitions, data was obtained, as shown in Figure 3(d). With this drone data, raster and vector data are obtained. Raster data as photos have the advantage of being high in spatial resolution and free from cloud cover.

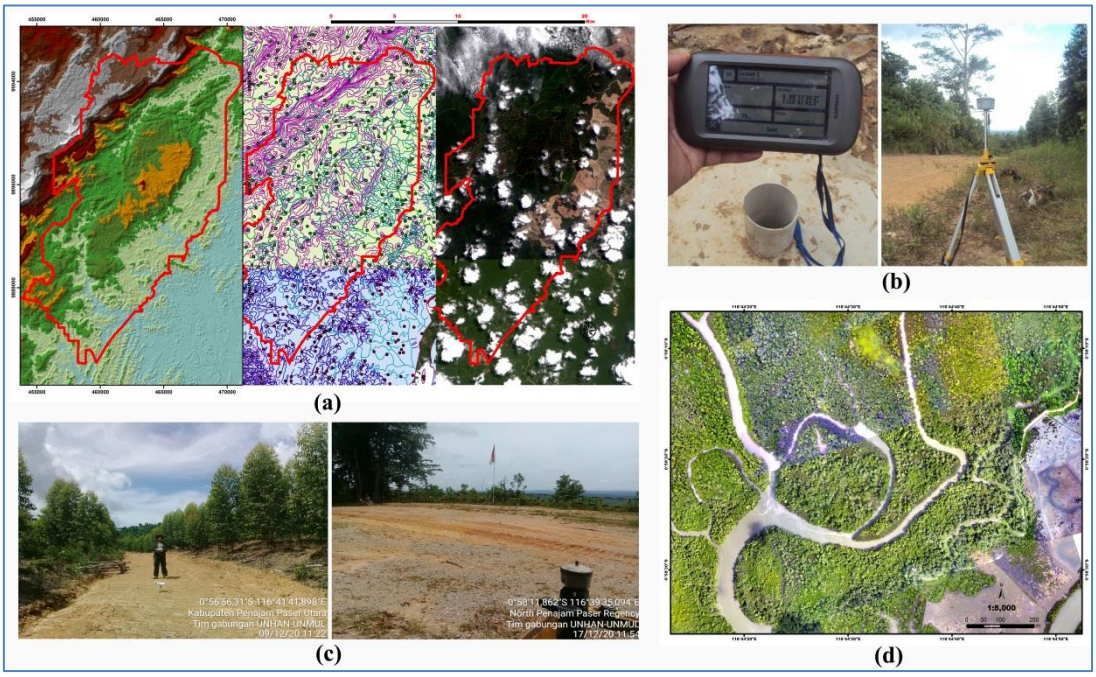

Figure 3. (a) Data from UGSG and BIG Website; (b) GPS;(c) Geo-referenced photo; and (d) Drone acquisition

GEOINT data processing uses ArcMap v10.8.1 and ArcGIS Pro v2.4 software combined with CityEngine 2020. All of them are ESRI product applications. They are using the Modelbuilders tool, the tool package, a defense model, is created using these various data.

3.2.1. Buffer

To produce the area with defenses and regions not covered by the defense, it carried a buffer process out on the data points of military installations on the island of Borneo. It included military installations from KODAM to border posts.

Using the formula (1), a simulation is carried out to see the vacancies in our troop titles on the island of Borneo. By combining several parameters, namely the minimum distance to the coast to avoid attacks from the sea and the minimum distance to land borders with neighboring countries as initial calculation data. Geospatial intelligence model to find a COIS candidate, which is as follows:

ANCLD = (BI - Buffer (C,BD)) – (((ΣBuffer(TU,BD) .....(1)

where,

ANCLD = Areas Not Covered by Land Defense (hectares/ha)

BI = Borneo Island (kilometre/km)

C = Coastline (kilometre/km)

TU = Troop Unit (kilometre/km)

BD = Buffer Diameter (kilometre/km)

RESULTS AND DISCUSSION

Making a geospatial intelligence model begins with collecting geospatial intelligence data in the form of defense points on the island of Borneo, both from land, sea, and air defense. As an approach in determining the defense locations, see Figure 4. Referring to Figure 5 from the buffer results for all aspects of defense, we can see which areas have our defense's strengths and weaknesses.

By using formula (1), a simulation is carried out to see the vacancies in our troop titles on the island of Borneo. By combining several parameters, namely the minimum distance to the coast to avoid attacks from the sea and the minimum distance to land borders with neighboring countries as initial calculation data..

ANCD = (BI - Buffer (C,BD)) – (((ΣBuffer(TU,BD)

= (BI – Buffer (C, 35)) – (((Buffer (Brigade,70)) + ((Buffer (Batalyon, 15)) + ((Buffer (KODAM,150)) + ((Buffer (KOREM,45)) + ((Buffer (KODIM,10)) + ((Buffer (Koramil, 3)) + ((Buffer (Border Post, 3))

From the buffer process of existing defense locations in Borneo and the location of point 0 COIS which has been selected as the basis for designing a geospatial intelligence model for the COIS site location. We processed the data using the modelbuilder facility in Arcgis. Figure 4 shows the distribution of points of strength such as the offices of Kodam, Korem, Kodim, Koramil, Battalion and other units on a scale of twenty million. ANCLD on the island of Borneo is 411,665 km^2 of Indonesia's land area of 531,864 km^2 or 77%. Figure 5.

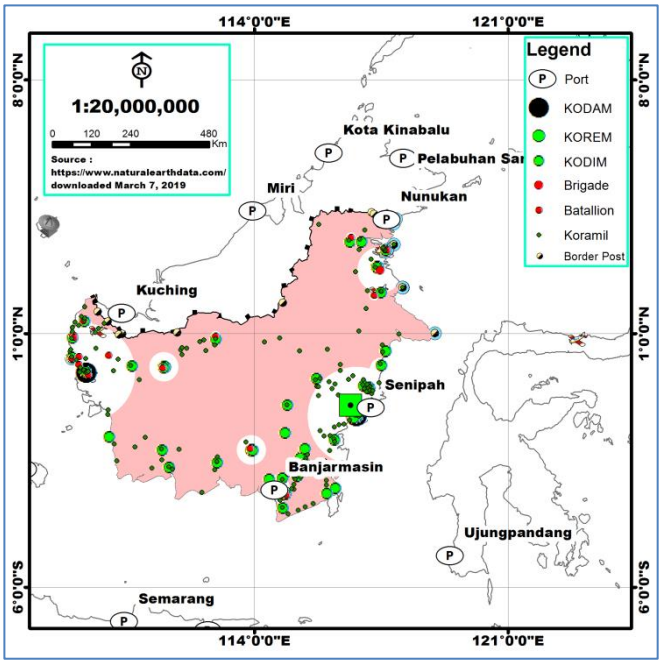

Figure 4. Site Location Model Creation with modelbuilder

While in Figure 5, parameters such as .shp of the island of Borneo, troop units, and villages are entered in ArcGIS Modelbuilders. To display the buffer results with the add to display menu as shown in Figure 4 and 5. The process results can be seen in several places, especially along the Makassar Strait and close to the Natuna Sea there are KODAM and battalions.

So that in terms of defense it has more power than the middle area.

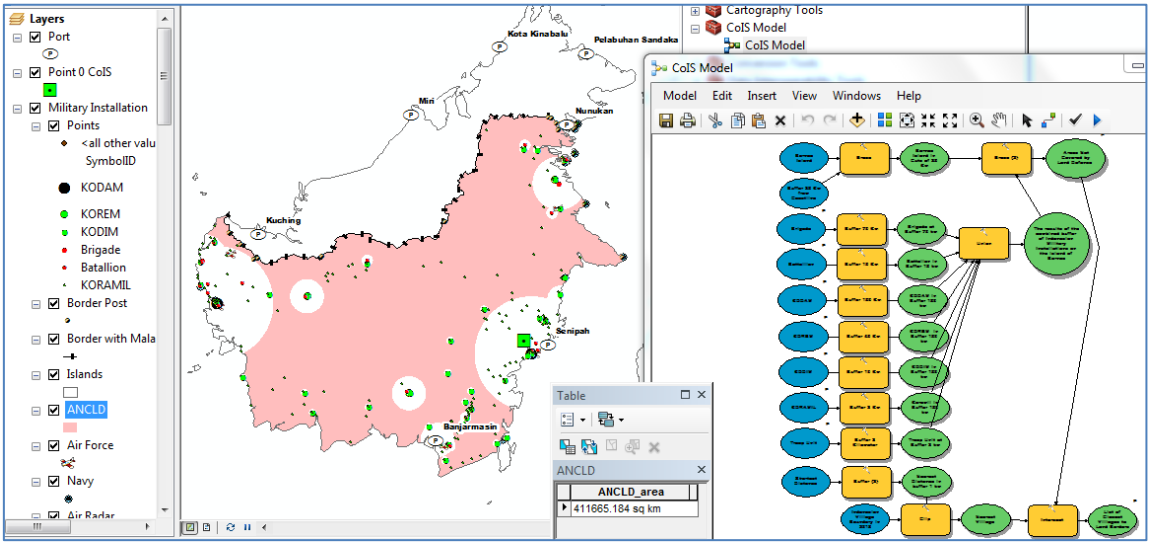

Figure 5. Defense Scenarios in new COIS locations

Seeing how vast the area was, that still had a void of defense, even though the area had forested and marshy terrain. However, it must still be a concern if the enemy uses the vacancy to infiltrate from a non-military perspective such as narcotics abuse or infiltration with ethnicity, religion, race and class nuances which are easily ignited because our country has various ethnicities, religions and ethnicities. Figure 6 shows that 39 villages have a vulnerability calculated by the closest distance from point 0 CoIS to the land border with Malaysia.

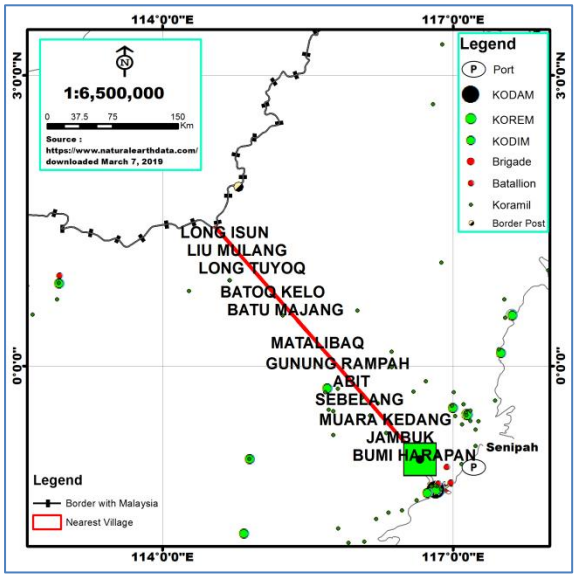

Figure 6. Villages that Land Raid Scenarios pass through

Implementing SISHANKAMRATA based on our nation's experience in dealing with invaders during the war of independence requires the cooperation of all parties. The vastness of the island of Borneo with challenging terrain becomes a challenge in troop coordination. We must fulfil the need for intelligence data ourselves by utilizing all the Indonesian people.

CONCLUSIONS

The combination of HUMINT, OSINT and GEOINT data can describe the defense conditions on the island of Borneo. Drone data has been successfully used as supplementary information with satellite data to detect changes in terrain behaviour. Field information can be calculated precisely, which may be useful for defense and civilian purposes. We have carried out the quantitative analysis in this research, which can be used for various applications such as defense to plan troop movements, actual terrain scenarios, disasters, and others.

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