

Maximizing Efficient Use Of Remote Sensing Imagery For Land And Spatial Planning

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Received: Jan 27, 2024; Accepted: Feb 27, 2024; Published: Mar 27, 2024;

Abstract: Now all over the world there is a shift in the learning paradigm towards increasingly modern learning, the problems faced in Indonesia are very different from those in other countries. The need to accelerate spatial planning is increasingly needed day by day, but the lack of use of high resolution satellite imagery (CSRT) is very minimal because many still prefer to use aerial photography, even though satellite imagery has now developed rapidly and has an accuracy of 0.5 meters/centi, to obtain The data that I will use, I use the Mendeley software platform, and also search for several scientific journals from existing websites. The results that I got from the research study that I wrote as stated above is the importance of maximizing the use and utilization of images. This scientific study can conclude that the use of satellite imagery is no less important than aerial photography which requires more time in the field, the use of satellite imagery is a way to obtain information about the earth's surface from a certain distance. The concept is simple: if you observe a landscape object but it is still unclear, change perspective by standing up to see the object more clearly.

Keywords: Remote sensing science, Satellite image, Spatial.



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Introduction. Remote sensing, a term commonly heard by those involved in spatial planning, Satellite imagery, which can be described as photographs from space, is an image of the Earth or other planets captured by observer satellites orbiting outside the Earth, controlled by governments or companies from around the world. Satellite imagery can also be applied in the fields of oceanography, meteorology, fisheries, biodiversity, agriculture, forestry, cartography, geology, landscape, intelligence, education, regional planning, and other areas. Many countries in the world have launched satellite programs including the Landsat satellite program. Landsat is the oldest satellite program still in operation. Landsat satellites have been observing the Earth optically with a resolution of 30 meters since the early 1980s. Since the launch of Landsat 5, images have been captured in the infrared spectrum. Landsat 7 and Landsat 8 satellites are currently orbiting the Earth and actively imaging its surface. Meanwhile, Landsat 9 satellite is currently in the project phase. Local information is based on location in a specific coordinate system as a reference basis. This is why there is a talent to connect different information to one point in the field, link them, analyze the data and ultimately show the results. Remote sensing addresses several questions such as: Location/land, Conditions, Trends, Shapes, Variations, and Modeling. It is this capability that distinguishes remote sensing from other information system sciences.(A. et al., 2003)

As more satellites are launched, satellites with increasingly sophisticated sensors are also developing. Satellites with passive sensors use external resources (outside the satellite) to power

them when recording objects around the Earth's surface. The primary source of energy is electromagnetic waves generated by sunlight. Electromagnetic wave radiation from the sun directly strikes the outer layer of the Earth, but initially, it must "pass through the atmospheric barrier." Electromagnetic waves, which have successfully overcome the "barrier" problem in the atmosphere, then propagate to the Earth's surface and trigger the influence of various objects located inside and near the Earth's surface. These objects react or interact with the electromagnetic waves that strike them, which can be distortion, scattering, or absorption. Because satellite sensors are hundreds of kilometers above the Earth's surface, interactions such as distortion of these objects are the recorded phenomena by the satellite's sensors.

Various types of satellite images are made with different pixel resolutions, periods, and different channel bands. The higher the pixel resolution and the more bands it has, the larger the satellite image interval. This requires further development of statistical methods. Processing large and multidimensional data poses a challenge for its users. The limited availability of tag data also demands the development of methods and advanced learning for accurate, appropriate classification, and with limited tag numbers.

Therefore, there is a paradigm shift in learning worldwide towards more advanced learning directions. The use of digital media is increasingly utilized to address the challenges of the industrial revolution era. The learning process, especially in the field of remote sensing, is expected to meet these qualifications by creating individuals who are skilled, accurate, and precise. (Gadeng et al., 2022)

Specifically, the issue of remote sensing teaching materials in Indonesia is very different from other countries. Remote sensing material is the most needed material by students abroad. This is supported by the research results of Naumann et al. from 2013 in Germany, Poland, and England, which show that more than half of the total number of students learn with satellite image aids. In Turkey, South Korea, and the United States, even less than 50% of our students learn using satellite images. This indicates that if used correctly, satellite imagery can have a significant impact on our education. Case studies from several countries provide facts that more than 70% of total students can correctly/almost correctly explain whether jobs related to satellite imagery are interesting when asked. Additionally, they are asked about their reasons for deepening remote sensing material as an important factor for the latest learning process. This process has proven the great desire of students for remote sensing knowledge in the majority of states. Therefore, a redesign is needed to anticipate these challenges. (Gadeng et al., 2022)

The importance of remote sensing is also very broad, as it can be used for observing the sea, identifying and monitoring weather, vegetation, and even land. Therefore, it needs to be handled intensively, including through donations to the Agrarian Reform Object Land (TORA). Mapping the potential of regions carried out by the Ministry of Agrarian and Spatial Planning/National Land Agency (ATR/BPN) has been considered not optimal so far when comparing the set objectives with the annual success. The use of Google Earth imagery and geographic information systems can help in the allocation and identification process of potential abandoned areas. The data used is Google Earth imagery, which allows land cover interpretation as a basis for land use decision-making. In this study, land cover classification uses guided classification with the maximum likelihood algorithm. The research results show that with the assistance of Google Earth and geospatial data, it is possible to present the latest information on existing land use and identify unused areas according to the granted rights instructions. It is hoped that the interpretation and analysis results conducted using GIS can be used to identify potential abandoned land objects and then used as a basis for managing abandoned land, thus accelerating the management of land, sea, weather, and vegetation classifications in Indonesia. (Utami et al., 2018)

Therefore, intensive efforts are needed to accelerate the development of public knowledge in the field of remote sensing in Indonesia by promoting learning, both in academic institutions and by increasing self-directed literacy among individuals in the community.

The difference between my writing and other works is that the majority of the writings by individuals I've encountered previously indicate that the handling of this issue is still unclear. In this written work, I will strive to provide the best handling solutions to aid in educating that remote sensing knowledge can contribute more effectively to spatial planning and land management, which will undoubtedly be crucial indefinitely.

Research Method

To obtain the data I will be using, I utilize the Mendeley software platform, as well as searching for several scientific journals from various websites. Therefore, for the completion of this Scientific Journal, the method to be employed in this research is the literature review method. The technique of literature review or bibliographic study can be carried out by collecting literature data, taking notes, reading, and processing materials used in the research. As for the analysis process of this Scientific Journal, I will extensively use references from previous and recent scientific journals within the last 10 years to examine this issue.

Results and Discussion

1. Results

The findings from the study outlined above emphasize the importance of maximizing the use and utilization of remote sensing imagery for accelerating spatial planning. As an example of proven learning methods, modern teaching approaches directly incorporate remote sensing software such as ENVI.

Beyond its primary function, there are numerous sub-functions that can still be implemented to aid in the acceleration of area identification and the monitoring of changing landscapes. The use of this imagery itself is incredibly broad and diverse. "Flexible" and "extensive" are perhaps fitting terms to succinctly describe it. Its potential applications include weather condition detection, oceanography, vegetation analysis, and, of course, analyzing the layout of specific areas as focused on in this research study.

As an example, apart from spatial planning, remote sensing imagery finds application in disaster monitoring related to water, such as floods and inundations. I once came across a journal that revealed the effectiveness of using the GSWIR method in calculating floodplain areas. The GSWIR method utilizes band 3 (Green) and frequency band 6 (Short Wave Infrared) for its calculations. Band 3, known as Green, clearly delineates the boundary between land and water. It provides information about vegetation and non-vegetation areas as well as additional reflection values within the water, aiding in visualizing inundation. Band 6, named Short Wave Infrared (SWIR), is used to differentiate between unlimited land and other objects. This zone corresponds to studies on groundwater content, plant water, rocks, and geology in general. (Triscowati & Wijayanto, 2020)

For the main focus of this study, which is the utilization of satellite imagery for spatial planning, the findings indicate that there is still much that needs to be learned by our society due to the general lack of knowledge about geodesy, especially remote sensing, among the populace. Because of the continued significance of disciplines like Remote Sensing, as stated in a scientific journal, the guided classification process is becoming urgent to present data that yields mapping information for land cover that can be used for the interests of related sectors. The guided classification method has a high impact on the quality of mapping needed according to the identified class objects. With this guidance, map accuracy meets requirements. This study conducted multi-parameter validation testing in the classification method driven by the proposed norms using 38 participants who are experts in remote sensing from 14 cities in Indonesia. Stakeholder participants in remote sensing include electricity users, consultants, and academic experts. Field research methods were used to conduct in-depth interviews. The results show that on average, 94% of stakeholder participants agree with the 49 parameters required by these standards, while 94% agree and 6% "disagree" agree with 10 standard parameters. These parameters include: cloud coverage criteria, standard telescope, use of spatial resolution 30 m - 250 m, use of spatial resolution 2.5 m - 10 m, 10% training sample, 95% training sample accuracy, total accuracy value, user and producer. It is recommended that the

10 parameters that "disagree" with the Komtek 07-01 be considered when including supporting numbers or supporting documents. (Purwanto & Lukiawan, 2019)

2. Discussion

The advantages gained from remote sensing data include its ability to cover very large areas since the photos are obtained through aerial photography. Additionally, this data can be obtained quickly and accurately, even in areas that are difficult to access with ground surveys. This reduces the cost, time, and effort required for data collection. In reality, the use of remote sensing for spatial planning is highly necessary. Analyzing the terrain and surrounding vegetation from a distance proves to be very helpful. Even urban planners and surveyors who are tasked with mapping but lack sufficient spatial information find remote sensing to be indispensable. (Somantri, 2016)

For learning, one can employ modern teaching processes, wherein initially educators should delve into the basics of remote sensing. Once educators are proficient in using remote sensing applications that support remote mapping, they can utilize these applications. Educators can implement direct teaching-learning methods, including planned learning models, abstract spatial simulation learning models, and project-based learning forms. Direct Teaching Learning Model is a form of learning that aims to master context and skills, both academically and non-academically, across various educational fields.



(Traditional and modern based learning mind maps)

Bruce Joyce categorizes the Direct Instruction learning model within the group of behavioral instruction models, where the learning outcomes are skills and abilities related to the subject matter. In this context, knowledge of how different software is used to process satellite image data in remote sensing is necessary.

Project-based learning model is an immersive learning approach that engages students in the research process and aims to create works representing their knowledge. In this case, the student work format is based on the project-based learning model, focusing on Landsat 8 satellite image maps. The tools and materials required include a laptop, projector, mouse, and ENVI Classic application. The ENVI application allows both teachers and students to perform various operations related to image data processing, such as uploading satellite images and interpreting them.

This learning approach not only enhances spatial intelligence and understanding of spatial analysis but also improves the quality of future map results using remote sensing and geographic information systems methods. Furthermore, this learning can strengthen students' love for their homeland and their patriotism, as they gain a good understanding of the vast knowledge of land and sea territories and the distribution of natural resources across the unitary state of the Republic of Indonesia based on satellite imagery.

Although the accuracy level is not fully guaranteed due to certain limitations in using satellite image data, such as unwanted objects accidentally captured by satellites like clouds or shadows of objects that overly cover the region of interest, the surrounding data. For instance, the construction of facilities around us, such as the construction of an airport in Kediri Regency, will affect various land types, including rice fields, settlements, plantations, and industries. By using remote sensing imagery, land cover can be analyzed during the airport construction process, analyzing land utilization using satellite image data for development. The research results indicate that the construction process of an airport in one of the areas in East Java, especially Kediri, affects land use change processes. (Surya Ramadhan, 2022)

Apart from common areas in society, whether urban or rural, the use of remote sensing is particularly crucial for minority areas such as slopes, mountains, coastlines, and even remote regions. Surveillance and monitoring are more necessary for such areas than for areas commonly inhabited by communities in urban and rural settings. For example, in agricultural fields, remote sensing technology, including MODIS (Moderate Resolution Imaging Spectroradiometer) imagery, is frequently used to monitor paddy fields over large areas. Multi-temporal MODIS data can be utilized to develop vegetation indices sensitive to vegetation and biomass (living organisms' mass) and water content in plants. Therefore, accelerating land analysis for spatial planning purposes can be maximized as efficiently as possible. (Hernawati et al., 2018)

Additionally, the lack of spatial information in these areas is significantly minimal compared to the information available in urban and rural areas. In urban and rural areas, direct surveys can still be conducted through field intermediaries such as neighbors or local residents to obtain desired information. This is different in mountainous and coastal areas where community life is scarce. Even if there are communities, they are not as extensive as those in cities and villages. Record lists or the consolidation of remote sensing data obtained by sensors can be installed on manned/unmanned aircraft or satellites. Remote sensing technology can be a solution to detect land cover for extensive rural settlement areas, eliminating the need for extensive field monitoring. (Wardana et al., 2014)

As the classification task becomes more complex and its accuracy decreases when only one image sequence is used as a feature, probing with multiple image sequences is currently under development. This study is an introduction to plant spectral profiles based on seasons. From here, the temporal spectral patterns of plants during the vegetation period are known. The EVI (Enhanced Vegetation Index) spectral pattern of forest plants is believed to be consistent throughout the year, while the pattern of rice plants increases and then decreases during the growing season, forming a cubic curve. Examination of these spectral patterns should be conducted directly in the field to observe the spectral radiance of a plant during the growing season. Certain plant species exhibit different spectral characteristics or follow unique temporal spectral profiles. Additionally, information about environmental conditions is required to anticipate possible limitations and forecast future challenges in advanced spatial planning. (Triscowati & Wijayanto, 2020).

No	Penulis	Metode	Jenis Citra Satelit	Kelas klasifikasi	Akurasi atau R ²
1	(Guan, Huang, Liu, Meng, & Liu, 2016), Vietnam	Time-Series clustering dengan jarak DTW	MODIS	Lahan padi, bukan lahan padi	• R² pada luasan nasional sebesar 0,809. • R² pada luasan 500km² s/d 1000 km² sebesar 0,226
2	(Dirgahayu, Parsa, & Carolita, 1997), Indonesia	Maximum likelihood	Radar ERS-1 SAR	Air/rawa, pemukiman, padi, tebu, kebun campur	• Akurasi klasifikasi tebu sebesar 89,8% • Akurasi pemetaan sebesar 78,3%
3	(Parsa et al., 2017), Indonesia	Regresi kubik	Modis dan Landsat-8	Air, bera, vegetatif awal, veg. akhir, generatif awal, generatif akhir	• R² regresi 94,25 s/d 99,15 • Akurasi pengujian lapangan 53% s/d 59%, dan 86% ketika MODIS di smooting dulu

(Several Examples of Conventional Statistical Methods for Classifying Satellite Images)

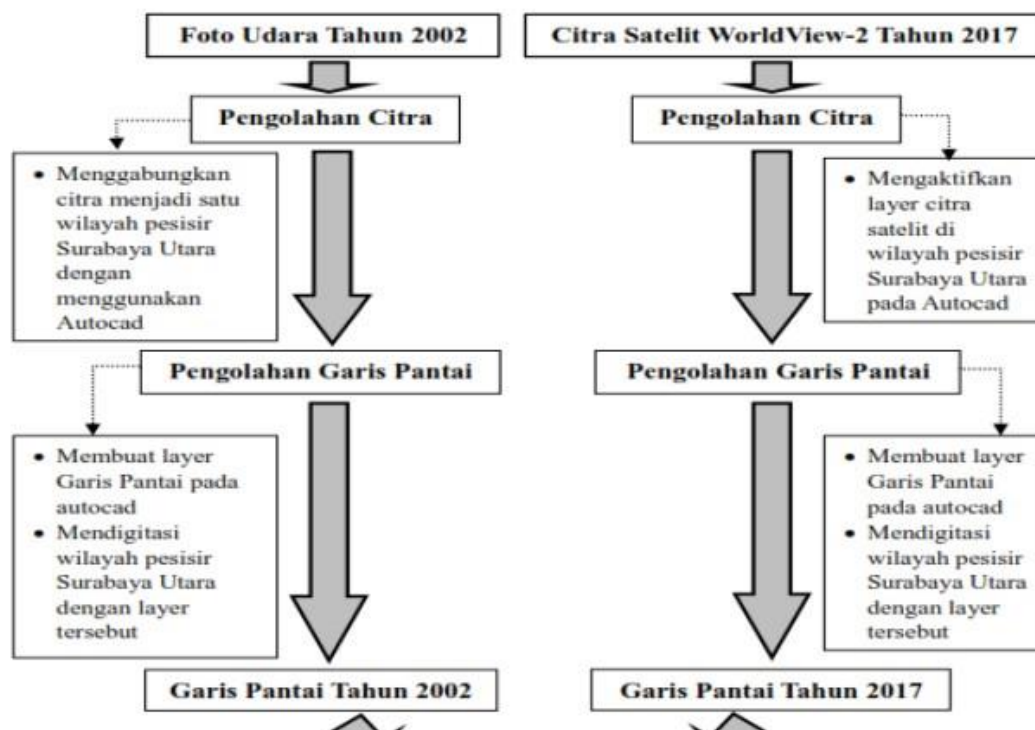
Therefore, information such as floods and potential water disasters in the area are necessary. An example of flood mitigation calculation method is GSWIR. The GSWIR method calculation process previously utilized moisture indices to detect potential floods. The moisture index values have several levels: -1.0 to 0 means no water formation or no moisture value, 0 to 0.33 indicates average moisture levels including water formations, and 0.33 to 1 indicates high moisture levels. (Maria Octarina et al., 2019)

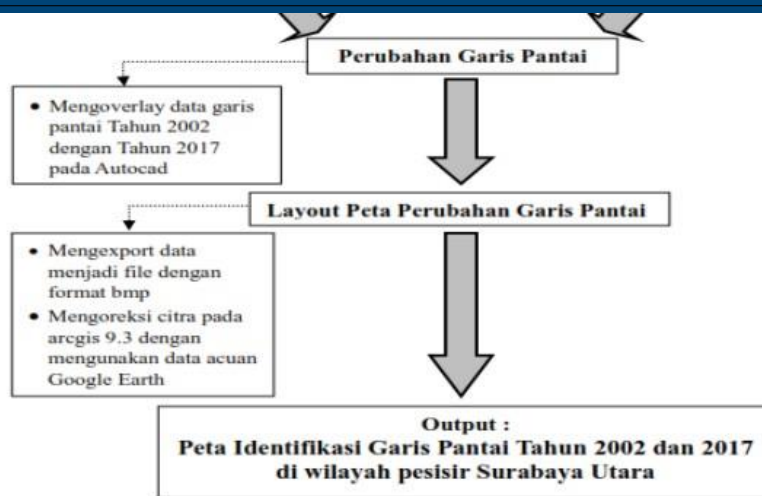
To determine the spatial distribution of qualitative erosion prediction, remote sensing imagery can be used. The qualitative erosion model constructed is not solely determined by the overlapping results of input parameter evaluation data, but rather based on Training Data (training data) based on artificial neural network classification. (Arif et al., 2018)

In coastal areas and flood-prone areas, remote sensing is also required to assess water potential and coastal oceanography to provide appropriate planning for the referenced areas. One of the techniques used is to map flood-prone and flood-prone areas.

Coastal areas are dynamic and constantly changing. Coastal land, including beaches, is sensitive to various natural phenomena, one of which is shoreline alteration. The coastline is the boundary of the sea at the highest tide. Its position changes according to tidal conditions. The coastline may change due to natural factors affecting coastal conditions, including waves and currents causing sedimentation and erosion. These factors also affect changes in river conditions flowing into the water.

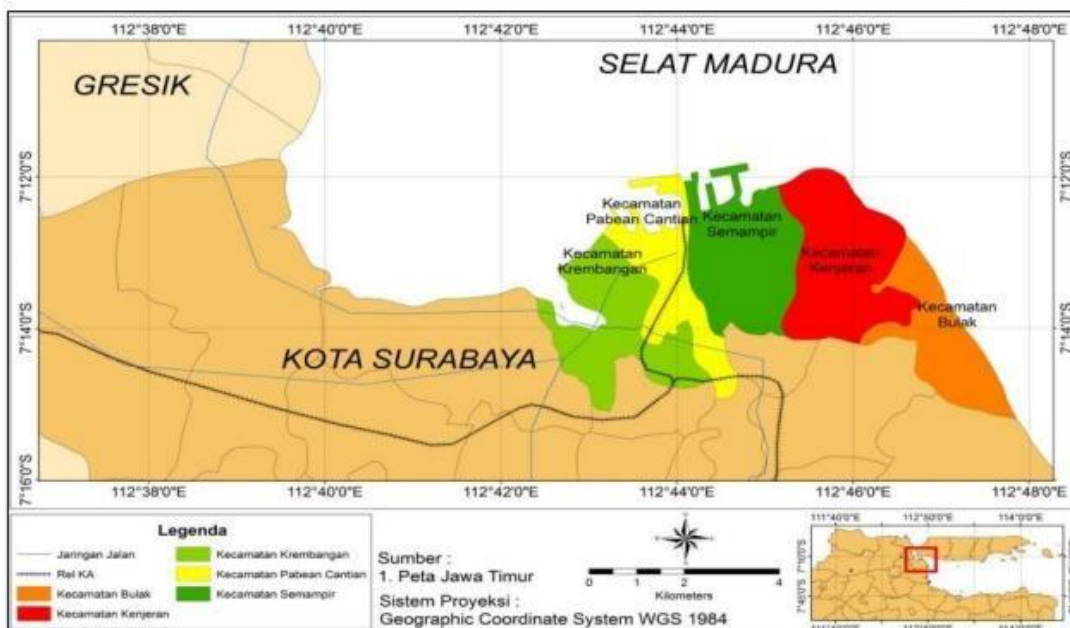
The analysis results from satellite imagery in this study used two variations of approaches because the data used were taken from different database sources. In the processing of aeronautical imagery, the image compositing process is first carried out, which combines two or more images into one complete image. However, this process is not necessary for WV2 imagery





(Image of the image processing process in coastal areas)

Satellite data processing continues with digitizing the coastline on each image. Digitization is a method of processing analog data into digital data by combining attribute data, which is information about the objects used. The digitization process uses on-screen digitizing methods in ArcMap digitization software to create boundaries between land and sea. These boundaries are used to determine changes in the coastline. Analysis of coastline changes uses the ruler tool available in ArcMap. After identifying the coastline boundary data layer for each satellite image, the analysis continues with an overlay process. This involves overlaying the coastlines of each period to calculate their development and changes. The study area is located in North Surabaya, which includes several districts: Krembangan, Pabean Cantian, Semampir, Kenjeran, and Bulak. The research location map can be seen in the following figure.



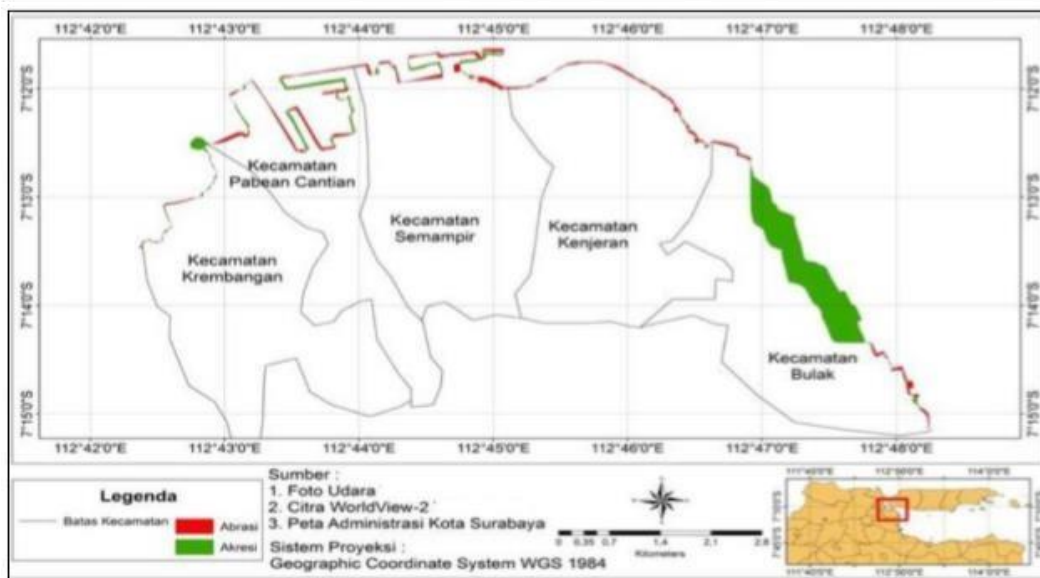
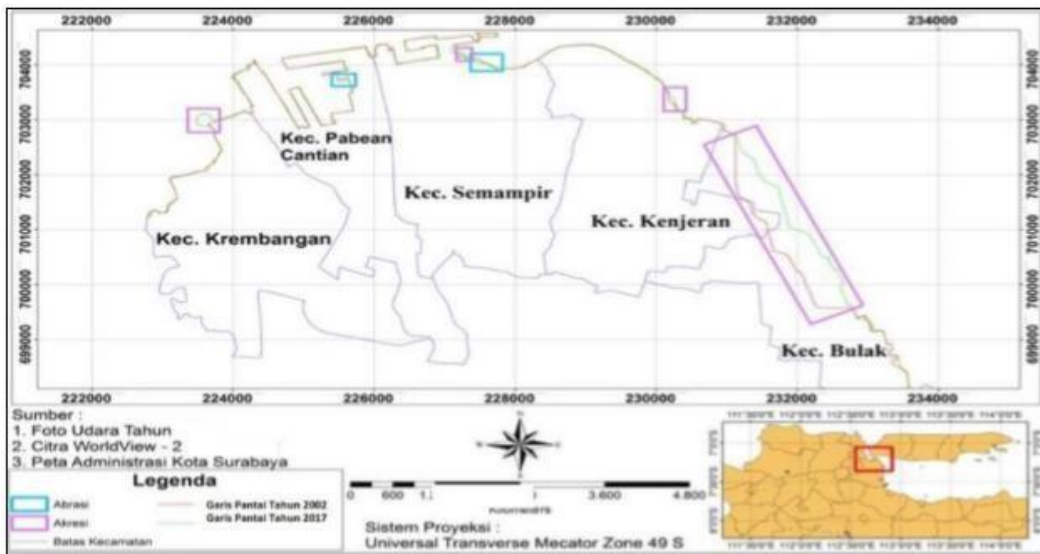
(Image of research location map)

The results obtained in this study consist of the Coastal Map of 2002, Coastal Map of 2017, Coastal Development Map of 2002-2017, and their respective areas. The calculation of coastline changes and maps is based on aerial images from 2002 and WV2 2017 images using Autocad 2007 and ArcGIS 9.3 software. The analysis was conducted along the northern coastal area of Surabaya, starting from the Krembangan area to the Bulak district. (Suharyo & Hidayah, 2019)

No	Nama Kecamatan	Luas Wilayah (km ⁴)
1	Krembangan	8,34
2	Pabean Cantian	6,80
3	Semampir	8,76
4	Kenjeran	7,64
5	Bulak	6,78

Sumber : BPS Kota Surabaya, 2015

(Table of coastal area areas)



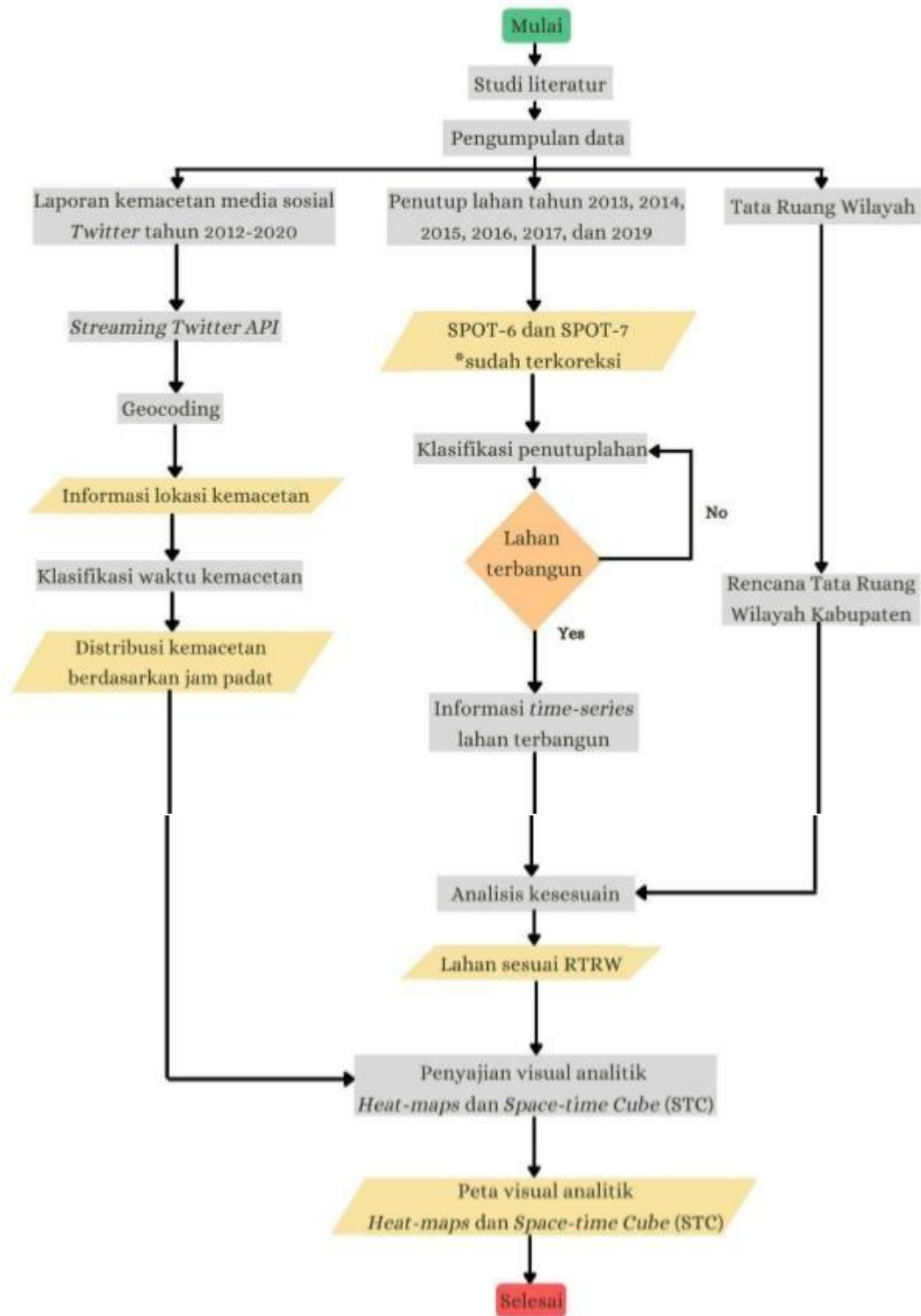
(Results of overlay maps of coastal areas[1], and maps of changes in coastal line boundaries[2])

Meanwhile, specifically in aerial photos, flooded areas can be interpreted from the appearance of landforms, with the most common being river and coastal surface features. Based on dark or bright patterns (darkness usually in wet areas), vegetation related to landforms (fine-textured swamp vegetation or swamp forests), signs of flooding (specific patterns due to flooding), and human adaptation to floods, such as dams. Flood indicators that can be identified through interpretive techniques include landforms. Flood-prone areas have higher soil moisture levels than non-flood-prone areas. These indicators include water bodies, soil composition, soil moisture, aquatic vegetation, and human-made flood control measures. Flood indicators, such as flood areas from flood target areas, indicate high vulnerability to floods. However, soil moisture in floodplains often becomes the target, which is why updated satellite sensing with advancements in technology and analytical techniques in science also supports the improvement of surrounding data and spatial

planning. Satellite image classification techniques can be used to classify land. (Marsuhandi et al., 2020)

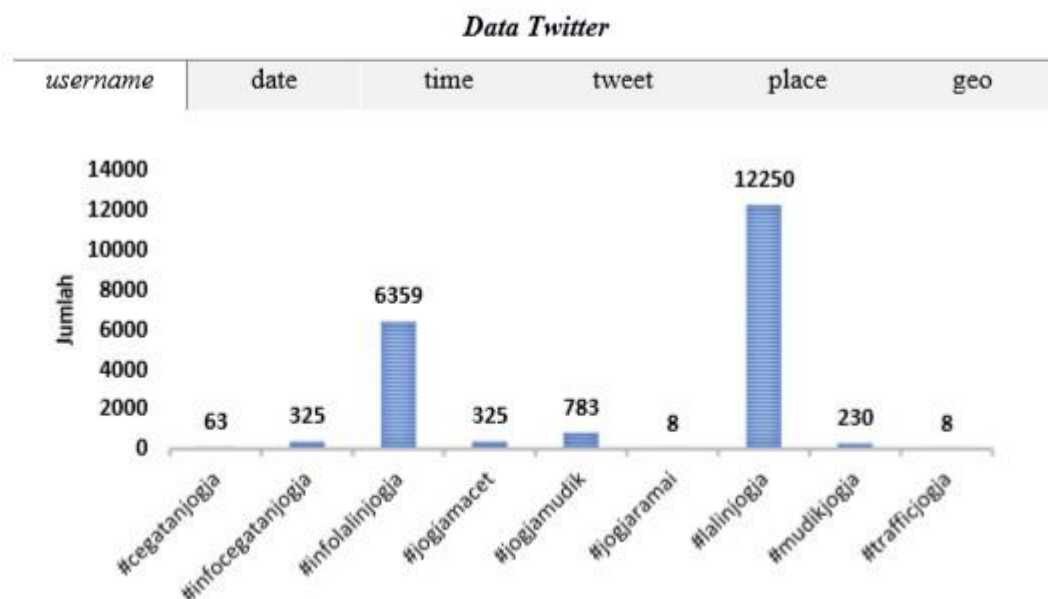
Essentially, the potential for flooding is greater in inundation-prone areas than in non-inundation areas. The characteristics of flood-prone areas from aerial and satellite images can be identified using flood indicators. Aerial photos can be used to predict the extent and distribution of floods, provided that low-lying areas have been detailed geomorphologically mapped, establishing a strong reciprocal relationship between flood depth and duration with water sources. Landform units and flood disaster vulnerability. Even if aerial photos are taken at different locations from when disasters such as floods, storms, and the like occur, flood hazard conditions can be mapped by displaying disaster impacts and information on local populations and water balances in the analysis area. Flood vulnerability maps, created using aerial flood indicators and new satellite images, show how vulnerable the area is to flooding. Therefore, the use of remote sensing satellite images is also essential for spatial planning in coastal and disaster-prone areas. The advantage of using satellite imagery for this purpose is its ability to display extensive data coverage in the study area, making it easier to analyze disaster-prone areas and floods. Furthermore, remote sensing technology can save costs, time, and effort in producing accurate data. Geomorphological approaches (landforms) can be used to map flood-prone areas. Common flood indicators are floodplains, coastal terraces, marshes, and ponds. (Somantri, 2016b)

Along with the development of technology, remote sensing satellite imagery can also be used to monitor land use/development that is not suitable for transportation facilitation. For example, in Yogyakarta Regency, there is a situation related to traffic congestion where the road is starting to become unstable, the speed decreases relatively quickly due to obstacles, and the freedom of movement is relatively low. According to a study by INRIX Research (2017), Yogyakarta is the 60th most populous city in the world after Jakarta, Bandung, and Malang, and the fourth most populous in Indonesia. In addition to rush hour factors, congestion occurs because urban development occurs in suburban areas. Changes in land use affect macro and micro traffic arrangements. Land use practices include various social, economic, cultural, and other activities that are interrelated. Land use itself generally consists of three factors: human, activity, and place that interact with each other. In transportation and cultivation systems, there is a close relationship between transportation and cultivation.



(Data Processing, Analysis and Dissemination steps to help land management and speed up transportation)

The method used includes web scraping API. The data obtained is called raw or primary data that has not yet been sorted. Data mining is done based on hashtag keywords (#) related to traffic congestion. The keywords used include: #cegatanjogja, #infocegatanjogja, #infolalinjogja, #jogjamacet, #jogjamudik, #jogjaramai, #lalinjogja, #mudikjogja, and #trafficjogja. The raw or primary data obtained is then sorted according to the research information needs. The sorting results yield relevant information.



(Format Data Received)

After obtaining the raw data, individuals proceed with filtering and removing data on the Twitter platform, known as reposts or retweets. The filtered data is then spatially described by breaking down the positional information and coordinates. This is followed by the topographic dissemination stage, also known as the stage of forming the results of data analysis obtained through variables and data collections using visualization techniques. The process involves representing tabular information on geochemical maps using software such as ArcGIS Pro and ILWIS. The information presented by geovisualization includes the results of traffic density analysis for the period 2013-2020 obtained from the Twitter social network in the form of Spatial Heat Maps and Space-Time Blocks (STC).



(Contoh data yang sudah diolah)

Moving forward, with the sufficient information at hand, it is possible to proceed with restructuring the land to streamline and maximize future development plans, especially for areas around major highways, as they are typically the largest CrowdedAreas. (Purnama & Aditya, 2022)

1. Conclusion

The conclusion drawn from this scientific study highlights the importance of using remote sensing, particularly satellite imagery interpretation, which significantly facilitates the process of obtaining information about the Earth's surface from a distance. According to the findings and available data, satellite imagery proves to be more time and energy efficient compared to using aerial photographs, which require preparation and processing steps for their production. Here are the main points obtained from this study:

1. Surface Monitoring:

Satellite imagery provides broad and detailed views of the Earth's surface from a height, enabling spatial planners to better understand land use patterns, population distribution, urban development, and other environmental changes that can affect spatial planning.

2. Urban Mapping and Planning:

Satellite imagery allows urban planners to map urban areas with high detail. This information can be used to plan infrastructure development such as roads, housing, public facilities, and land zoning for different uses.

3. Natural Disaster Monitoring:

Satellite imagery can aid in monitoring and mitigating natural disasters such as floods, landslides, forest fires, and earthquakes. Data from satellite imagery can provide direct information about surface changes that can be used to coordinate emergency response and recovery efforts.

4. Natural Resource Management:

Satellite imagery enables monitoring and mapping of natural resources such as forests, agricultural land, water bodies, and mines. This information can be used for sustainable management and to identify potential conflicts between different land uses.

5. Environmental Change Analysis:

Researchers can analyze environmental changes such as deforestation, urbanization, and land degradation by using satellite imagery from different time periods. This information is crucial for planning sustainable spatial arrangements and identifying areas vulnerable to environmental changes.

6. Development Activities Monitoring and Evaluation:

Satellite imagery can be used to monitor development activities in real-time. By identifying the location and pattern of development, local governments can evaluate whether the development is in line with established spatial plans. If violations or discrepancies are found, corrective measures can be taken in accordance with applicable spatial regulations.

7. Mapping Proper Land Use:

Satellite imagery can be used to map proper land use according to established spatial plans. By analyzing satellite imagery, local governments can identify areas that are being used improperly, such as illegal construction in conservation areas or agricultural land being used for urban development. Law enforcement measures can be taken to restore land use in accordance with spatial plans.

8. Environmental Change Monitoring:

Satellite imagery can also be used to monitor environmental changes resulting from development activities or improper land use. By identifying environmental impacts of development or improper

land use, local governments can take preventive or corrective actions to protect the environment and ensure spatial sustainability.

9. Population Density Analysis:

Satellite imagery can be used to analyze population density in various regions. This information can assist in urban planning and the distribution of public facilities such as schools, hospitals, and shopping centers according to population needs.

10. Urban Growth Monitoring:

Satellite imagery can be used to monitor urban growth and urban area development. By understanding urban growth patterns, local governments can develop spatial policies that support sustainable and efficient urban development.

In conclusion, satellite imagery plays a crucial role in spatial management by providing accurate, extensive, and up-to-date data on the Earth's surface conditions and changes. By utilizing satellite imagery to monitor, evaluate, and regulate development activities and land use, accelerated spatial planning regulations can be implemented more effectively and efficiently. This will help achieve sustainable spatial development goals that benefit society.

The concept is simple: if you observe a landscape object but it is still unclear, change perspective by standing to see the object more clearly. Indonesia has a vast territory. According to the Central Statistics Agency (BPS), Indonesia has a land and sea area of 5,193,250 km² and is divided into 16,766 islands. Observing areas is time-consuming and expensive if done as part of field surveys. Therefore, remote sensing data is very important because it can save not only time but also costs. Involved in mapping and measuring the area and number of islands above Indonesia.

One of the most important sub-functions of remote sensing is its use in disaster preparedness. This is very important considering that Indonesia is located in the Pacific Ring of Fire surrounding the Pacific Basin. The geographical location makes Indonesia prone to natural disasters such as floods and the like.

Various changes in regions, including changes in land use, can be clearly seen using multi-temporal satellite data. This can help from a tax perspective because data from previous years is for vacant land, but the latest data shows that industry has been built on this land.

However, despite the many advantages of Remote Sensing, unfortunately many individuals still do not maximize the use of this knowledge. This is where the importance of maximizing the expansion of insights into remote sensing lies, especially in our own country, which according to several remote sensing research studies is very much needed.

In summary, there are still many uses of Remote Sensing Sub that can greatly affect spatial planning and the implementation process of spatial planning in land in general. However, apart from the advantages of its utilization, unfortunately there are still many individuals who do not maximize the science of remote sensing itself. That is why it is important to maximize the broadening of insights into remote sensing, especially in our own country, which according to several remote sensing research studies is very much needed.

Recommendations

A suggestion that can be drawn from all the discussions above is to maximize education related to remote sensing sciences such as geography, geodesy, mapping, planning, and even land management in a more serious and in-depth manner. It cannot be denied that remote sensing is highly necessary considering the increasing demand for spatial planning and the limited time constraints. Therefore, quick and accurate data about the surrounding area is needed, which requires information and knowledge from remote sensing itself. Additionally, the expanding scope of fields and the narrowing of information over time can also be considerations in promoting remote sensing education in schools and higher education institutions.

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