Study On The Availability Of Public Green Open Space Using Geographic Information System Data On Public Green Open Space In The City Of Tebing Tinggi

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Abstract.

Based on Spatial Planning Law No. 26 of 2007 concerning Spatial Planning, Article 29 states that the proportion of public green open space is 20% of the city area. In Tebing Tinggi City, based on the 2013-2033 RTRW of Tebing Tinggi City, it is stated that Public RTH covers an area of approximately 72.49 Ha or 1.89% of the city area, which means it is not in accordance with the mandate of Spatial Planning Law No. 26 2007 concerning Spatial Planning. This research was conducted to assess the availability of existing public green open space in Tebing Tinggi City based on image interpretation techniques, spatial distribution, the area of existing public green open space, the service radius of existing public green open space, and the suitability of existing public green open space land. This type of research uses quantitative research and uses spatial analysis techniques. The results identified as many as 60 public green open spaces in Tebing Tinggi City with an accuracy score of 86.36%, which means that the interpretation is considered correct because the spatial distribution pattern of public green open spaces in Tebing Tinggi City is random because the distribution of public green open spaces is not evenly distributed in all sub-districts in Tebing Tinggi City. From the results of the spatial distribution pattern, digitization was then carried out with the result that the total public open space area was 105.27 Ha, which was dominated by the burial area of 59.67 Ha or 57.07%. Then, based on each area of green open space obtained, a topological classification of public green open space is carried out, consisting of 7 typologies of green open space, namely City Forest, City Park, District Park, Village Park, RW Park, RT Park, Cemetery and Green Belt, which is then analyzed. Service radius. As a result, it is known that the City of Tebing Tinggi has not been served optimally by public green open space because there is not yet one type of public green open space typology that is capable of serving the city of Tebing Tinggi based on buffer analysis carried out using ArcGis. The only public green open space whose service radius almost covers the city of Tebing Tinggi is the cemetery whose existing existence is capable of serving 99.19 percent of the area of the city of Tebing Tinggi. Finally, a land suitability analysis was carried out between the existing public green open space and the Tebing Tinggi City RTRW for 2013-2033 which resulted in land suitability of 79.92%. Meanwhile, the remaining 20.08% was designated for areas that were not public green open space.

Keywords: *Public Green Open Space, Image Interpretation, Service Radius and Land Suitability.*

I. INTRODUCTION

RTH (Green Open Space) is an important factor in an urban system. Based on Spatial Planning Law No. 26 of 2007 concerning Spatial Planning, green open space (RTH) is an elongated area/path and/or cluster, whose use is more open, where plants grow, both those that grow naturally and those that are deliberately planted. Article 29 states that green open space consists of public green open space and private green open space, with the proportion of public green open space being 20% (twenty percent) of the city area and private green open space being 10% (ten percent) of the city area. [1],[7] The existence of green open space has a positive impact on an urban area, especially public green open space, because its function is to reduce pollutants, produce oxygen, improve the quality of the local climate, control solar radiation, increase architectural and aesthetic value, increase tourism and economic potential, and as a place for social interaction (Directorate of Planning Building and Environment, Directorate General of Human Settlements, Department of Public Works). On the other hand, the reduction in the area of green open spaces results in degradation of the quality of the city's living environment, thereby affecting various aspects of urban life, such as frequent flooding, increasing air pollution along with the increasing number of vehicles crowding city streets by the Department.

[2],[9] In the Minister of Agrarian and Spatial Planning Regulation Number 14 of 2022 concerning the Provision and Utilization of Green Open Space, it is also stated that Public Green Open Space is at least 20% of the area or urban area. Meanwhile, the area of public green open space in Tebing Tinggi City is

based on Tebing Tinggi City Regional Regulation Number 4 of 2013 concerning Tebing Tinggi City Regional Spatial Planning for 2013-2033, in article 29 paragraph (2) it is stated that the area of public green open space is approximately 72.49 (seventy two point forty nine) Ha or 1.89% (one point eighty nine percent) of the city area consisting of city parks spread across Rambutan District, Tebing Tinggi Kota District, Padang Hilir District with an area approximately 21.13 Ha and public cemeteries in Padang Hilir District, Padang Hulu District, Padang Hilir District, Tebing Tinggi Kota District and Ba Jenis District with an area of approximately 51.36 Ha.

In fact, in ATR/BPN Ministerial Regulation No. 11 of 2021 concerning Procedures for Preparing, Reviewing, Revisioning and Issuing Substance Approval of Provincial, Regency, City Spatial Plans and Detailed Spatial Plans in article 11 paragraph (4) it is stated that Public green open space is at least 20% (twenty percent) of the city area. [1],[7],[15],[20],Therefore, it is interesting to know the availability of public green open space in Tebing Tinggi City, considering that the role of Tebing Tinggi City in the RTRW of North Sumatra Province is as a Regional Activity Center (PKW) which functions for city government activities and a trade and services center that serves provincial scale activities or several districts/cities in North Sumatra Province. [3],[21],[22] To obtain data on the availability of public green open space distribution in Tebing Tinggi City, one way is to use Google Earth Satellite Imagery. Google Earth is a program to map the earth from the superimposition of images collected from satellite mapping, aerial photography and 3D GIS globes. [14] The features available on Google Earth make it the only best and most complete digital map in this era, so it can be used to detect and map existing public open space in Tebing Tinggi City using remote sensing techniques or remote sensing processed using GIS (Geographic Information System). [5],[6],[9],

II. METHODS

This type of research uses quantitative research. Quantitative Research is a research method based on the philosophy of positivism, used to research certain populations or samples, collecting data using research instruments, quantitative or statistical data analysis, with the aim of testing predetermined hypotheses. The research period was carried out from January 2023 to October 2023. [17],[19] In this research, secondary data sources include: a. Google Earth satellite image maps; b. Public RTH Topology and Public RTH Service Radius based on ATR/BPN Ministerial Regulation No. 14 of 2022 concerning the Provision and Utilization of Green Open Space; c. Data on studies or policies related to green open space in Tebing Tinggi City; d. Tebing Tinggi City Regional Regulation Number 4 of 2013 concerning Tebing Tinggi City Regional Spatial Planning for 2013-2033. [20]

The sampling technique in this research is non-probability sampling, namely purposive sampling technique. purposive sampling is a technique for sampling data sources with certain considerations, taking into account criteria that are appropriate to the research, so that sampling is not carried out randomly but is carried out based on the researcher's policy. [12],[13] The survey was carried out on objects, namely Public Green Open Space, which were difficult to interpret or where there were still doubts, so a survey was carried out to ensure their suitability for the conditions in the field. [8],[17]

The steps for analyzing the data in this research are as follows: [4]

1. Analysis of the Existing Public Open Space in Tebing Tinggi City using Image Interpretation Techniques [10]
2. Analysis of the Spatial Distribution of Existing Public RTH in Tebing Tinggi City carried out an interpretation accuracy test, namely by using the formula: KI = JKL/JTSL If the results are ≥ 85%, then the classification is considered correct. However, if the results do not meet the above requirements, reinterpretation will be carried out. [4],[11]
3. Analysis of the area of existing public open space in Tebing Tinggi City
4. Radius Analysis of Existing Public RTH Services in Tebing Tinggi City
5. Analysis of land suitability between the existing public green open space in Tebing Tinggi City and the RTRW in Tebing Tinggi City.

III. RESULT AND DISCUSSION

As the researcher explained in the method, the researcher used five data analysis steps. And in the final stage, researchers carried out a land suitability analysis between the existing public green open space in Tebing Tinggi City and the RTRW in Tebing Tinggi City. After knowing the spatial distribution, area and radius of Public RTH services as a result of image interpretation in Tebing Tinggi City, then to ensure the sustainability of the existing Public RTH in the future, land suitability is carried out, namely by overlaying the 2013-2033 RTRW spatial pattern map for Tebing Tinggi City with map of the existing public green open space which can later be used as material for consideration for improvements to the ongoing revision of the Tebing Tinggi City RTRW so that it can be accommodated so that it does not change function.

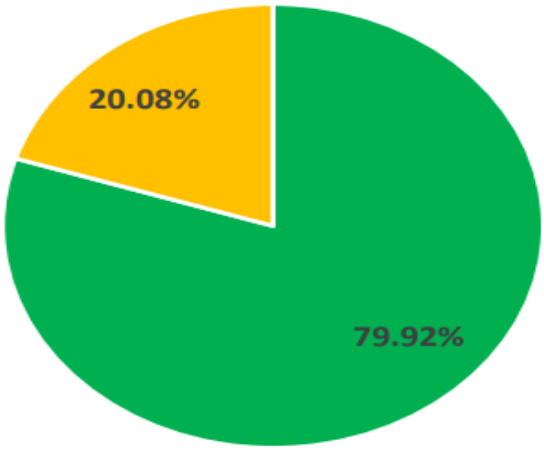

Fig 1. Percentage of Suitability of Existing Public RTH Land Based on Tebing Tinggi City RTRW 2013-2033

Based on the results of the land suitability analysis that has been carried out, it is known that the level of suitability of the existing Public RTH land for the Tebing Tinggi City RTRW for 2013-2033 is 79.92%, consisting of 78.09% land suitability for burials of 52.25% and Green Belt of 52.25%. 25.39%. Meanwhile, the remaining 1.83% is suitability for Public RTH land which has a different type of typology, so its designation is still as Public RTH, so it is still in the suitability category. for example, in the existing condition, based on the results of the RTH typology, it is a sub-district park, but in the 2013-2033 spatial pattern map of the Tebing Tinggi City RTRW, it is a sub-district park. Meanwhile, the remaining 20.08% is designated for areas that are not public green open space. For more details, see table IV.16 and map 4.12 below.

Table 1. Suitable Area of Existing Public RTH Land Based on Tebing Tinggi City RTRW 2013-2033

No.	Allocation Of Existing Public Rth Land Based On Tebing Tinggi City RTRW	Area (M^2)	Area (Ha)	Percentage (%)
1	The road	27,986.91	2.80	2.66
2	Green Line	267,253.89	26.73	25.39
3	Mixed Area	11,960.85	1.20	1.14
4	Public Facilities and Social Facilities Area	38,909.74	3.89	3.70
5	Urban Infrastructure Area	237.79	0.02	0.02
6	Electric Power Generation Area	153.90	0.02	0.01
7	Trade and Services Area	59697.30	5.97	5.67
8	Office area	5043.71	0.50	0.48
9	Local Protected Areas	11758.42	1.18	1.12
10	Defense and Security Area	838.20	0.08	0.08
11	Residential Area	48593.20	4.86	4.62
12	Industrial Designation Area	4180.36	0.42	0.40
13	Food Crop Area	1845.00	0.18	0.18
14	Burial	550033.22	55.00	52.25
15	City Jungle	4955.00	0.50	0.47
16	Non-Green Open Space	174.26	0.02	0.02

17	District Park	11885.18	1.19	1.13
18	Village Park	6957.77	0.70	0.66
19	City Park	262.99	0.03	0.02
	Total Area	1052727.69	105.27	100.00

Source: Analysis Results, 2023

Suitability of District Park Land

The land suitability of the District Park has a total area of 2.22 Ha. Based on the Tebing Tinggi City RTRW 2013-2033, the allocation consists of a Public Facilities Area and Social Facilities Area covering an area of 2.03 Ha, an Office Area covering an area of 0.18 Ha and a Defense and Security Area covering an area of 0.01 Ha, which means that the District Park can now be changed its function to an area other than green open space because its main function is not public green open space based on the Tebing Tinggi City RTRW 2013-2033.

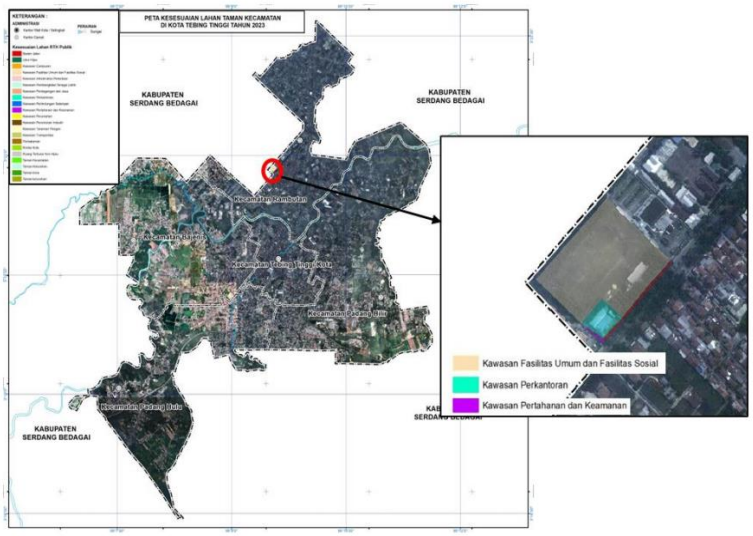

Fig 2. Overlay results of the suitability of the sub-district park land (existing) with the 2013-2033 Tebing Tinggi City RTRW, the designation of which is a public facilities and social facilities area, an office area, and a defense and security area

Suitability of Village Park Land

The land suitability of the Village Park has a total area of 3.51 Ha. Based on the Tebing Tinggi City RTRW 2013-2033, the designation consists of Mixed Areas, Public Facilities and Social Facilities Areas, Trade and Services Areas, District Park Residential Areas, and Village Parks with the following details:

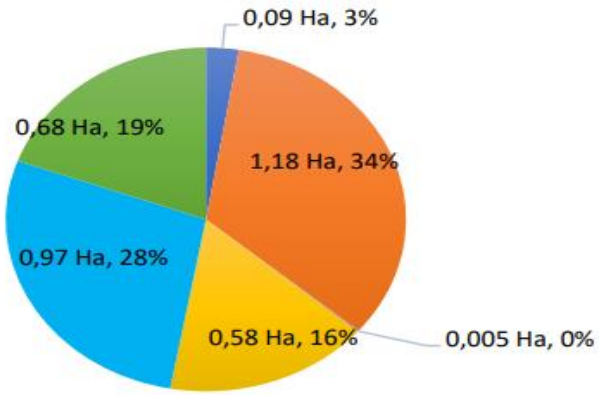

Fig 3. Area (Ha) Suitability of district Park Land Based on Tebing Tinggi City RTRW 2013-2033 The suitability of the sub-district park land is 0.68 Ha (19%) in Padang Hulu District, then the sub-district park land area is 0.97 Ha (28%) which is still suitable for use as a sub-district park because its function is still as Public RTH, only the typology differentiates it.

Then the remaining 53% of land use is land use other than RTH, which means that the existing Taman Kelurahan RTH can change its function to area use other than RTH because its main function is not public open space based on the 2013-2033 Tebing Tinggi City RTRW.

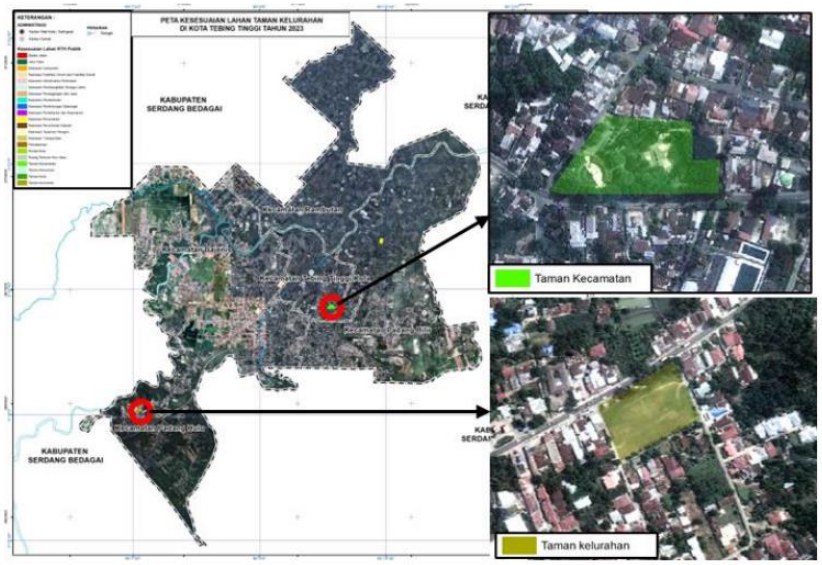

Fig 4. Overlay results of the suitability of the sub-district park land (existing) with the Tebing Tinggi City RTRW 2013-2033, which is designated as public green open space (sub-district parks and sub-district parks)

Suitability of RW Park Land

The suitability of the RW Park land has a total area of 1.33 Ha. Based on the Tebing Tinggi City RTRW 2013-2033, the designation consists of Public Facilities and Social Facilities Areas, Office Areas, Residential Areas, City Forests, Non-Green Open Spaces, and District Parks with the following details:

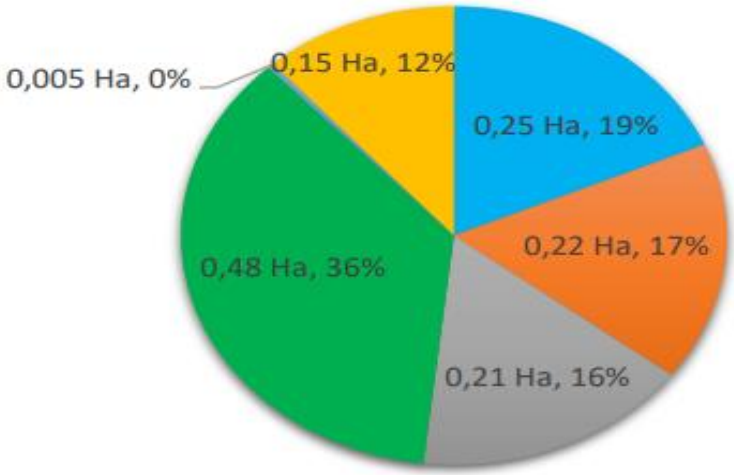

Fig 5. Area (Ha) Suitability of RW Park Land Based on Tebing Tinggi City RTRW 2013-2033

Land suitability for RW Park based on the 2013-2033 Tebing Tinggi City RTRW, there is no specific designation of land as RW Park, but the land allocation is for city forest with an area of 0.48 Ha (36%) and district park with an area of 0.15 Ha (12 %) which is still suitable for existing RW Park use. Then the remaining 64% of the land use is land use other than green open space, which means that the Taman RW green open space can now change its function to be used as an area other than green open space because its main function is not public green open space based on the 2013-2033 Tebing Tinggi City RTRW.

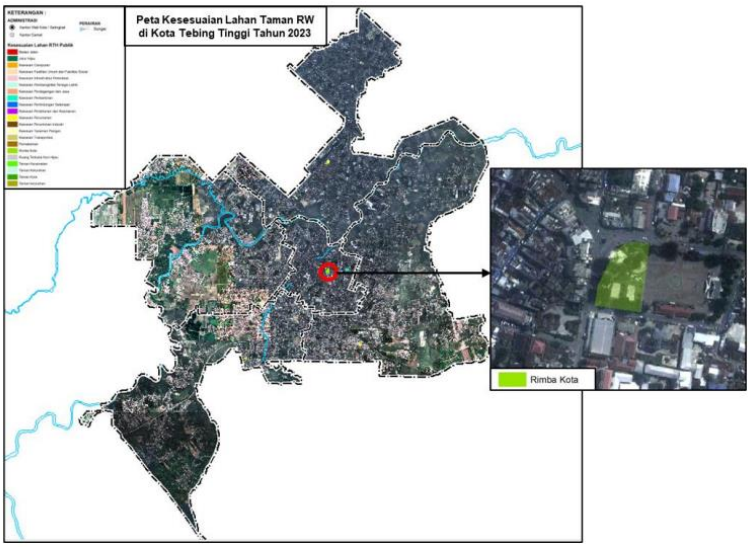

Fig 6. Overlay results of suitability of RW (existing) park land with Tebing Tinggi City's 2013-2033 RTRW, which is designated as public green open space (City Forest)

Suitability of RT Park Land

The suitability of the RT Park land has a total area of 0.12 Ha. Based on the Tebing Tinggi City RTRW 2013-2033, the designation consists of Roads, Office Areas, Residential Areas, City Forests, Non-Green Open Spaces, and District Parks with the following details.

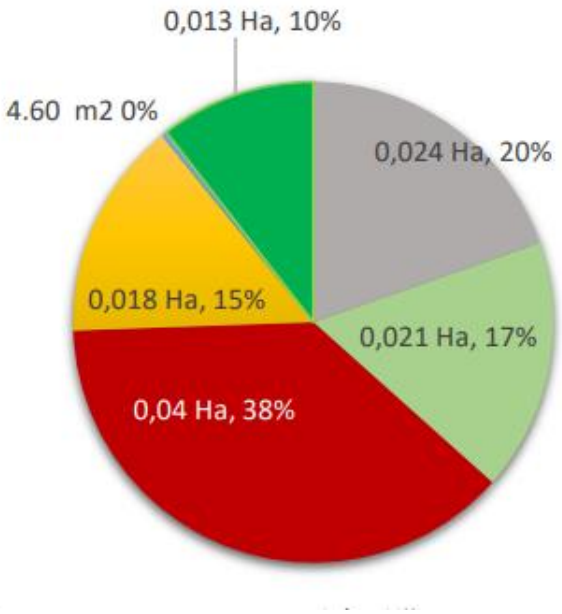

Fig 7. Area (m^2) Suitability of RT Park Land Based on Tebing Tinggi City RTRW 2013-2033

The suitability of RT park land based on the Tebing Tinggi City RTRW 2013-2033 does not have any specific land designation as RT park, but rather the land allocation for city parks and green belts which is also a typology of Public RTH with a total area of 0.03 Ha (37%) which is still suitable for existing RT park use. Then the remaining 64% of the land use is land use other than RTH, which means that the Taman RW RTH can now change its function to an area use other than RTH because its main function is not public open space based on the 2013-2033 Tebing Tinggi City RTRW.

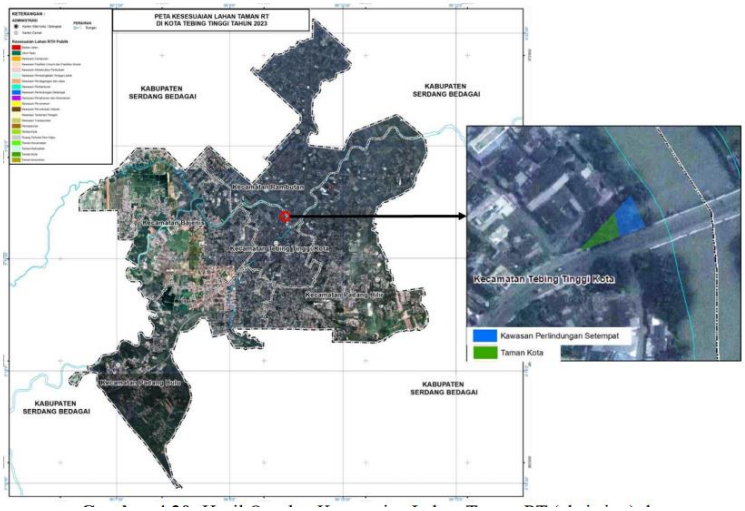

Fig 8. Overlay results of suitability of RT (existing) park land with Tebing Tinggi City's 2013-2033 RTRW, which is designated as a city park and local protected area

Suitability of Burial Grounds

The suitability of the cemetery land which has an area of 59.67 hectares, based on the Tebing Tinggi City RTRW 2013-2033, its designation consists of Road Body, Green Belt, Mixed Area, Public Facilities and Social Facilities Area, Trade and Services Area, Office Area, Local Protection Area , Residential Areas, Industrial Use Areas, Food Plantation Areas, and Cemeteries with the following details:

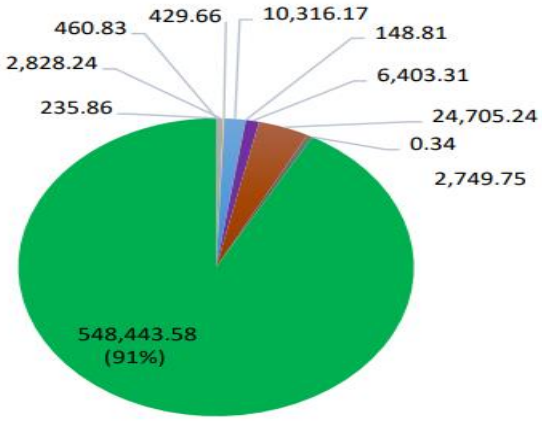

Fig 9. Area (m^2) Suitability of Burial Land Based on Tebing Tinggi City RTRW 2013-2033

The suitability of burial land is 59.67 hectares (91%) spread across all sub-districts in Tebing Tinggi City, the remaining 9% is designated for areas other than cemeteries.

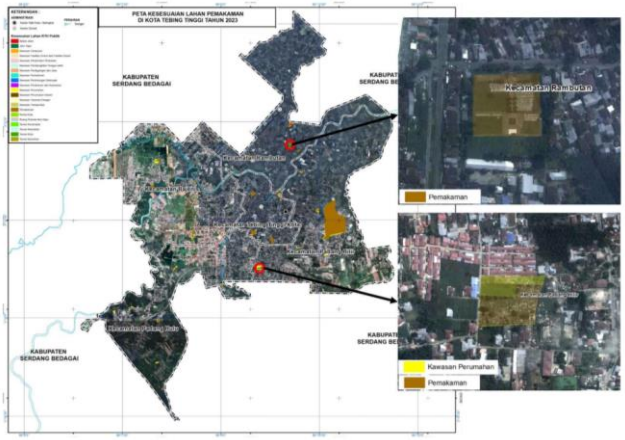

Fig 10. Overlay results of suitability of cemetery land (existing) with Tebing Tinggi City RTRW 2013-2033, which is intended for burial and housing

Suitability of Green Belt Land

The suitability of the Green Belt land which has an area of 38.42 Ha, based on the Tebing Tinggi City RTRW 2013-2033, its designation consists of Road Body, Green Belt, Mixed Area, Public Facilities and Social Facilities Area, Trade and Services Area, Office Area, Protection Area Local, Residential Areas, Industrial Use Areas, Food Plantation Areas, and Cemeteries with the following details:

Table 2. Area (Ha) Suitability of Green Belt Land Based on Tebing Tinggi City RTRW 2013-2033

RTH typology Existing Public	Allocation Of Existing Public Rth Land Based On Tebing Tinggi City RTRW	Area (Ha)	Percentage (%)
GREEN LINE	The road	2.73	7.10
	Green Line	26.68	69.45
	Mixed Area	0.82	2.14
	Public Facilities and Social Facilities Area	0.40	1.04
	Urban Infrastructure Area	0.02	0.06
	Electric Power Generation Area	0.02	0.04
	Trade and Services Area	4.89	12.72
	Office area	0.08	0.21
	Local Protected Areas	0.52	1.35
	Defense and Security Area	0.07	0.19
	Residential Area	1.59	4.14
	Industrial Designation Area	0.14	0.37
	Food Crop Area	0.18	0.48
	Burial	0.16	0.41
	City Jungle	0.01	0.04
	Non-Green Open Space	0.01	0.03
	District Park	0.06	0.17
	Village Park	0.01	0.03
	City Park	0.01	0.04
	Total Area	38.42	100

Source: Analysis Results, 2023

The suitability of the green belt land is 26.68 Ha (69.45%) which is spread throughout all sub-districts in Tebing Tinggi City, the remaining 30.55% is allocated for areas other than the green belt with the largest area, namely the Trade and Services Area with an area of 4.89 Ha (12.72%) and the road body is 2.73 Ha (7.1%).

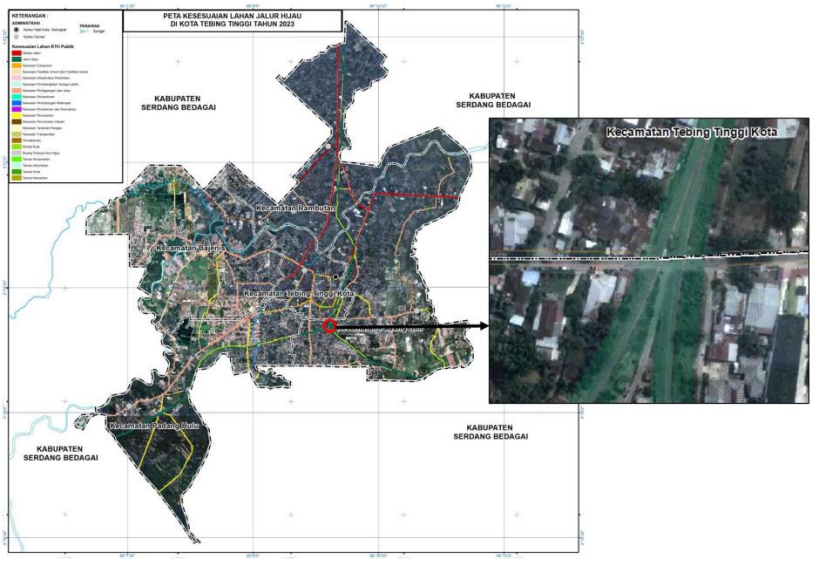

Fig 11. Overlay results of suitability of Green Belt (existing) land with Tebing Tinggi City RTRW for 2013-2033, which is also designated as Green Belt

IV. CONCLUSION

The area of the digitization results is in accordance with the typology classification based on the ATR/BPN Ministerial Regulation No.14 of 2022 concerning the Provision and Utilization of Public RTH, There are 57 public green open space locations with a typology classification of 1 park sub-district, 4 sub-district parks, 5 RW parks, 3 RT parks, and 44 cemeteries, as well as green lanes spread across Tebing Tinggi City. RTH The largest public typological classification result is Cemeteries with area 59.67 Ha or 57%, followed by the Green Belt with an area of 38.42 Ha while Public RTH results from typology classification with the smallest area is an RT Park with an area of 0.12 Ha or 0.12%. Based on the results of the land suitability study, the level of suitability of existing public green open space land for the Tebing Tinggi City RTRW for 2013-2033 is 79.92%. Meanwhile, those that were not appropriate were 20.08%.

V. RECOMMENDATION

In an effort to fulfill the provision of public green open space in Tebing Tinggi City, the Tebing Tinggi City Government must also accommodate the interests of the entire community in Tebing Tinggi City, one of which is the right of children to access public green open space by building RPTRAs (Child Friendly Integrated Public Spaces) which are mandated by law. -Law Number 35 of 2014 concerning child protection. RPTRA is a public space in the form of a child-friendly green open space which is equipped with various facilities that support children's development, comfort for parents, and a place for interaction for all residents from various circles.

REFERENCES

[1] ATR/BPN Ministerial Regulation No.11 of 2021 concerning Procedures for Preparing, Reviewing, Revisioning, and Issuing Approval of the Substance of Provincial, Regency, City Spatial Plans and Detailed Spatial Plans.

[2] Directorate of Building and Environmental Management, Directorate General of Human Settlements, Department of Public Works (2008).

[3] Estes, J.E., Simonett, D.S. 1975. Chapter 14: Fundamentals of image interpretation, in R.G. Reeves (Ed.), Manual of RemoteSensing, Vol. II, FallsChurch: American SocietyofPhotogrammetry, pp. 869–1076.

[4] Giles M. Foody (2001),

[5] Janssen, L.F.L and Hurneman C.G. 2001. Principles of Remote Sensing. ITC EducationalTexbooksSeries. ITC, Enshede, Netherlands.

[6] Khoirunnisa, L and Kurniawan, F. 2019. Geographic Information System for Mapping Agricultural Commodities and Climate Information Based on SlimFramework. Science, Applications, Computing and Information Technology, 1(1), p.16.

[7] Law Number 26 of 2007 concerning Spatial Planning

[8] Lillesand and Kiefer. 1998. Remote Sensing and Interpretation of Remote Sensing Images, Yogyakarta: Gadjah Mada University, Translation of Minister of Home Affairs Regulation Number 1 of 2007 concerning Arrangement of Green Open Space in Urban Areas.

[9] Nirwansyah, A.W., 2017. Basics of Geographic Information Systems and Their Applications Using ARCGIS 9.3. Deepublish.

[10] Harahap, et, all, Macrozoobenthos diversity as anbioindicator of the water quality in the Sungai Kualuh Labuhanbatu Utara, AACL Bioflux, 2022, Vol 15, Issue 6.

[11] Harahap, Arman. 2020. Species Composition & Ecology Index Of The Family Gobiidae At The Mangrove Belawan Of Sicanang Island ***International Journal of Scientific & Technology Research*** Volume 9, Issue 04, April 2020.

[12] Nugraha, R. and Rahayu, S., 2014. Study of Changes in the Availability of Green Open Space in Tembalang District, Semarang City, Based on Satellite Image Interpretation. Geoplanning: ***Journal of Geomatics and Planning***, 1(1), pp.13-20

[13] Pahleviannur,M.R.2019.Utilization of Geospatial Information Through Remote Sensing Digital Image Interpretation for Monitoring Land Use Changes.***JPIG (Journal of Education and Geography),***4(2), pp.18-26.

[14] Prahasta, E. 2009. Geographic Information Systems Basic Concepts (Geodesy & Geomatics Perspective), Informatics: Bandung.

[15] Purnomohadi, N. 2006. Green Open Space as a Main Element of City Spatial Planning, Jakarta, Directorate General of Spatial Planning
[16] Purwadhi, Sri. H. 2001. Digital Image Interpretation. Jakarta: Gramedia.
[17] Harahap, Arman ,2018, Macrozoobenthos diversity as bioindicator of water quality in the Bilah river, Rantauprapat, Medan. ***J. Phys***.: Conf. Ser. 1116 052026.
[18] A. Harahap, P. Hrp, N.K.A.R. Dewi, Macrozoobenthos diversity as anbioindicator of the water quality in the River Kualuh Labuhanbatu Utara, ***International Journal of Scientific & Technology Research***, 9(4), 2020, pp. 179-183.
[19] Regulation of the Minister of Agrarian Affairs and Spatial Planning Number 14 of 2022 concerning the Provision and Utilization of RTH.
[20] Sugiono. 2009. Quantitative, Qualitative and R&D Approach Research Methods. Bandung: Alphabeta.
[21] Sugiyono. 2008. Statistics for research, Alfabeta, Bandung.
[22] Sutanto, 1986. Introduction to Remote Sensing Volume I. UGM Press, Yogyakarta.
[23] Sutanto. 1987. Remote Sensing Research Methods for Geography. Lecture Papers for UMS Surakarta Teaching Staff. Harahap, A., et all (2021), Monitoring Of Macroinvertebrates Along Streams Of Bilah River ***International Journal of Conservation Sciencethis*** link is disabled, 12(1), pp. 247–258.
[24] Mamangkey,J.,Suryanto,D.,et all (2021).Isolation and enzyme bioprospection of bacteria associated to Bruguiera cylindrica, a mangrove plant of North Sumatra, Indonesia,Biotechnology Reports, 2021, 30, e00617.
[25] Suwargana, Nana. 2013. Spatial, Temporal and Spectral Resolution in LandsatSpot and Ikonos Satellite imagery. LAPAN: ***Scientific Journal***. Vol 1 Number 2.
[26] Tebing Tinggi City in Numbers, 2022
[27] Tebing Tinggi City Regional Regulation Number 4 of 2013 concerning Tebing Tinggi City Regional Spatial Planning for 2013-2033.