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EVALUATING INVEST MODEL FOR ESTIMATING SEDIMENT DELIVERY RATIO ON DIFFERENT LAND COVER TYPES IN TALOMO RIVER WATERSHED, DAVAO CITY, PHILIPPINES

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Abstract
The fragmentation of different landscapes resulted in altered ecosystem functions. This study aimed to estimate the sediment delivery ratio in the Talomo River watershed using the InVEST Modeling tool. Currently, no available data analyze sediment delivery in the Davao region on a watershed scale using SDR modeling. The analysis includes spatio-temporal analysis of various soil erosion parameters and predicting potential soil losses in different land cover types. Results show that the Talomo River watershed is classified as very low elevation, comprising 66.62% of the total land area or a total land area of 13,476.97 ha, rainfall classified as very high, covering 63.38% with a land area of 12,822 ha, and erosivity of 63.30% or 12,822. ha. In terms of Factor c (cover management factor), it shows that open/ barren has the highest with value of 1, the highest conservation factor is forest, shrub, grass barren land, built-up and water bodies with p-factor (conservation practice factor) of 1, erodibility of 71.79% for San Manuel Silt Clay Loam with a total land area of 14,523.53 ha. The highest soil erodibility in terms of soil class is andosols, with a value of 0.49, and soil type is classified as mountainous land. For slope length, the Talomo River watershed is considered level to nearly level with slope ranges from 0-3%, covering 86.32% or 17,352.44 ha of the total land area. InVEST model results show open/ barren land with the highest sediment export and inland water with the highest sediment deposition. Furthermore, results from the InVEST modeling have computed sediment export of 691,556.42 ton/ha./year, with the highest from open/ barren land, sediment deposition of 110,522,364.7 ton/ha./year with the highest from inland water, avoided erosion of 96,633,170.46 ton/ha./year, avoided export of 2,428,786,371.96 ton/ha./year, and potential soil loss of 114,344,366.94 ton/ha./year.

Keywords: Sediment Delivery Ratio, InVEST, GIS, Watershed, Davao City, Philippines.

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INTRODUCTION

Land use and land cover change (LULC) are critical for reflecting local and global changes (Allan et al. 2022). Urban areas have witnessed the greatest adaptations and alterations in developed land, water bodies, urban vegetation, and other forms of land. Thus, urbanized regions experience the most significant changes in LULC (Dou & Han 2021). An urgent need to prioritize soil management and conservation in watershed areas arises because of LULC, which aggravates soil erosion and sedimentation (Aghsaei et al. 2020). A study conducted in a watershed in Ethiopia showed a result of 23.4% to 31.3% sediment yield due to the area's expansion in agricultural lands from forest land (Kidane et al. 2019). Soil erosion and sedimentation result in water quality degradation, soil production losses, and a decreased ability to avert natural disasters (Panondi & Izumi 2021). Modeling and prediction of soil erosion have decades of history in helping assess ecosystem vulnerability and make conservation strategies (Kebede et al. 2021). Modeling allows for easier manipulation of data needed to predict soil erosion, facilitating the design of effective soil management and conservation strategies (Borrelli et al. 2021). This study aims to characterize the variables shaping sediment yield and sediment loss. After analyzing the factors, the sediment delivery ratio is quantified using InVEST modeling. Insufficient studies have been conducted using the InVEST modeling tool. Thus, this study also seeks to explore the InVEST SDR model to predict sediment yield and sediment loss. The InVEST Modelling Tool is then utilized to generate the sediment delivery ratio of the area. This is utilized to obtain a zone's statistical characteristics, enabling comparison or assessment of trends. This study assesses the sediment delivery ratio of the Talomo River watershed, specifically, it aims to analyze sediment delivery ratio parameters, namely, elevation, rainfall erosivity, cover management factor, conservation practice factor, slope length, and steepness factor (b) to estimate sediment delivery ratio Talomo River watershed based on different land classification.

MATERIAL AND METHODS

This study utilizes a descriptive quantitative design employing GIS-based and remote sensing techniques and InVEST modeling approaches. Estimating the sediment export and retention involves analysis of geological, topographical, and hydrological parameters. The slope length and slope steepness factor were analyzed using the Digital Elevation Model (DEM), which is extracted from IFSAR Data from DENR-Region XI. The cover management factor and support practice factor were identified through the classification of the land cover in the area. All numerical and vector data are processed into raster data and then resampled to have the same spatial resolution. The InVEST SDR Modelling tool would analyze the environmental parameters and provide data for the sediment delivery ratio of the area.

The Universal Soil Loss Equation (USLE) formula can be written as follows: USLE has the formula A=RKLSCP, where A represents computed soil loss, R is the rainfall-runoff erosivity factor, K is a soil erodibility factor, L is the slope length factor, S is the slope steepness factor, C is a cover management factor, and P is a supporting practice factor. The rainfall data is extracted from WorldClim.org, an online database. In terms of soil type, data was extracted from

Geoportal.gov.ph to analyze the soil erodibility factor represented by K. The Harmonized World Soil Database was utilized to classify the unclassified types. The slope length and steepness were analyzed using the Digital Elevation Model from IFSAR with 10 x 10 m grid resolution and projected to WGS 84/UTM zone 51N. The LULC component of the area is reclassified through QGIS to determine the cover management factor and the supporting practice factor. The cover management values were adapted from David's study (1988). Furthermore, other parameters that were used utilize the default values suggested by the InVEST manual. The soil erosivity and erodibility are numerical values, and they are processed in the Inverse Distance Weight Interpolation (IDW) in QGIS to match the spatial resolution. The InVEST tool was utilized to estimate the sediment export and retention of the Talomo River watershed. In ensuring the accuracy and reliability of the model, model calibration is done through a series of tests using the Borselli K parameter, which is the most sensitive parameter in the model, and was adjusted with an increment of 0.5 per calibration to minimize the model.

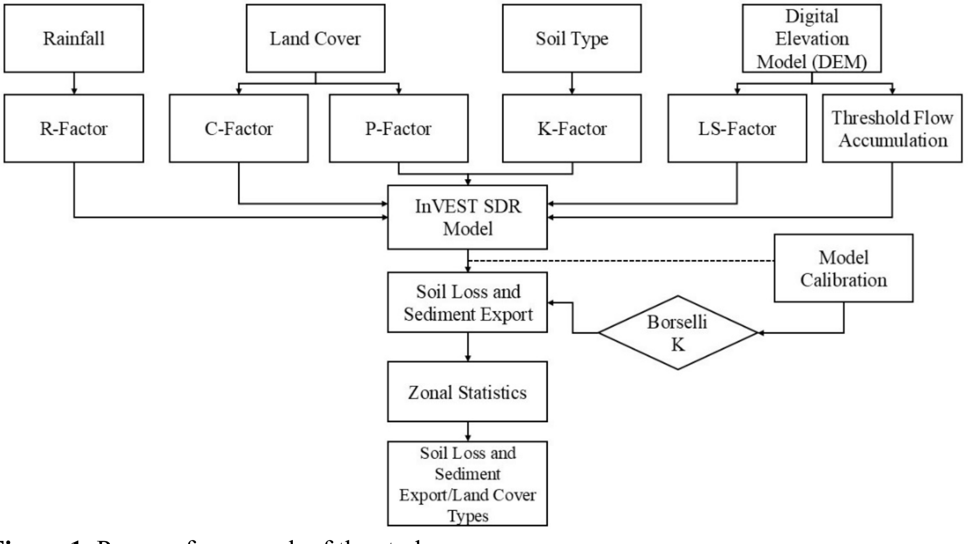

Figure 1. Process framework of the study.

A baseline value for sediment yield was used, and it was compared with the SDR model results to find the best-fit model. To estimate the soil loss and retention based on land cover types, zonal statistics provide average, sum, mean, maximum, and minimum statistical values (Chinnasamy et. al 2023) to obtain the statistical characteristics of a zone, which enables comparison or assess trends.

Talomo River Watershed is in Davao City, Davao Del Sur, Philippines, which is shown in Figure 2. The largest city in the Philippines in terms of land area is Davao City, which is found in the southern part. This city is highly urbanized, leading in the commerce, trade, and industry hub in Mindanao (Dumdumaya & Cabrera 2023). The Talomo River Watershed is located geographically between 7°8'4.87"N latitude and 125°26'35.66"E longitude. This watershed is where the Talomo River is situated, which is the second major drainage basin in Davao City (Acosta et al. 2019). The location has a total area of 21,578 hectares. Rapids and rocky terrain characterize this area, and canopy covers are found in its banks. According to DENR- RCBO (2017), this watershed has a drainage area of 244 km^2. Talomo River Watershed experiences the Type IV climate, which indicates that it experiences equal distribution of rainfall throughout the year (PAGASA 2014).

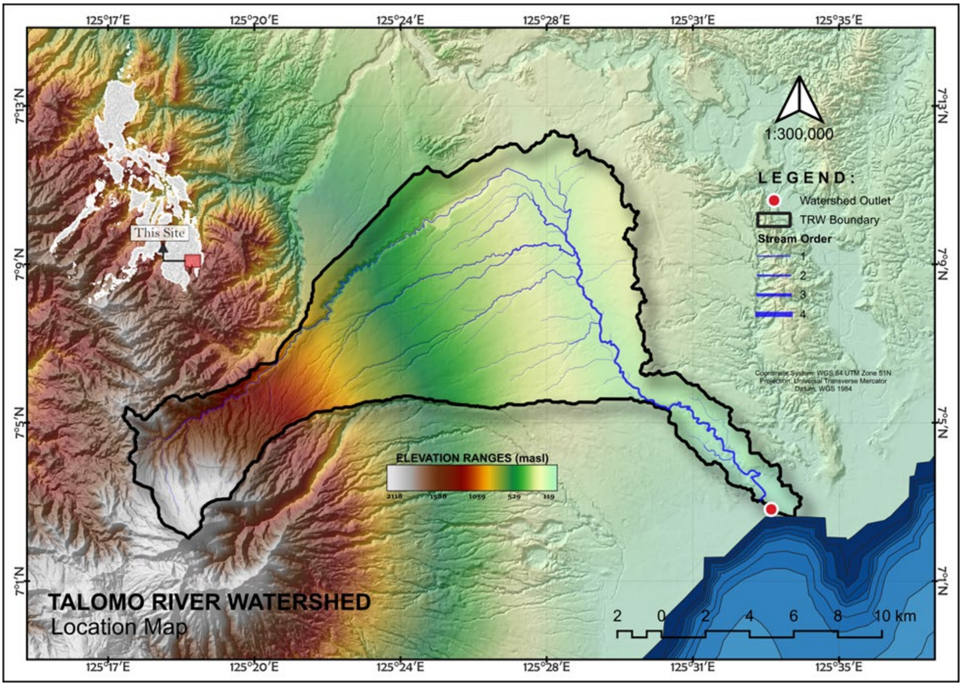

Figure 2. Map showing the location of Talomo River Watershed.

RESULTS AND DISCUSSION

Soil Erosion Parameters

Elevation

Presented in Table 1. and Figure 3 is the elevation range data of the Talomo River Watershed. Results have shown that most of the Talomo River watershed areas are categorized as very low elevations, with 13,476.97 hectares, which comprises 66.62% of the total land area. On the other hand, very high elevations have the least land coverage, with 241.45 ha, which is only 1.19% of the total land area. This implies that the Talomo River watershed is located at lower elevations, which can also be considered an influential factor in sediment deposition and erosion rates; although some parts of the watershed are considered at high elevations, the majority are found in the low-lying areas, which were influential in sediment transport. Moreover, elevation greatly affects soil erosion rates as it greatly affects slope length and steepness (Michalopoulou et al. 2022).

Table 1. Elevation ranges of Talomo River Watershed.

Class Number	Class Description	Area (ha)	%
1	Very Low	13476.97	66.62
2	Low	3645.95	18.02
3	Moderate	1696.01	8.38
4	High	1170.41	5.79
5	Very High	241.45	1.19
	Total	20230.80	100.00

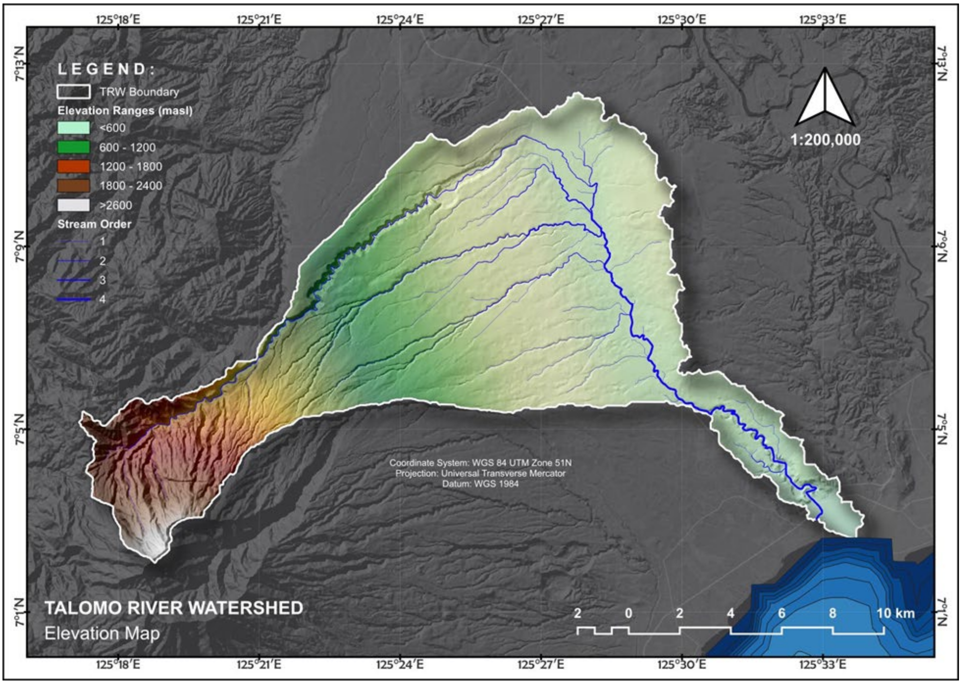

Figure 3. Elevation map of Talomo River Watershed.

Rainfall Erosivity Factor (R)

Table 2. shows the 10-year rainfall data of the Talomo River watershed from WorldClim.org. This data was analyzed for the erosivity factor in the USLE equation. Over the past ten years, the maximum rainfall values ranged from 3,020 to 3,150 mm, while the lowest values are between 2,500 and 2,630 mm. Results have shown that the majority of the study received classified as a very high amount of rainfall, which covers 63.30% of the total area of 12822.65 ha, while 4.89% received a very high amount of rainfall, which covers 990.02 ha of the total land area. This implies that areas receiving high rainfall tend to erode soil materials and deposit it into lower elevations. Nonetheless, areas with the highest amount of rainfall may experience higher rates of soil erosion, especially areas with less land cover (Zhao et al. 2021). As shown in Table 2., very high rainfall falls on the majority of the area. This increases the watershed's susceptibility to soil erosion. t

Figure 4 shows the R factor map of the Talomo River Watershed. The R factor or the rainfall-runoff erosivity factor, which is derived from rainfall data, quantifies the effect of rainfall on soil erosion (Yue et al. 2020). The rainfall values in millimeters have been converted to the units required by InVEST, which is MJ mm/(h.ha.year) using this formula: R = 0.7397 x p^1.847. Erosivity values correspond to the rainfall data gathered. It can be observed that higher rainfall erosivity is in areas that experience higher amounts of rainfall. This indicates further that rainfall can erode soil materials depending on the intensity of rain and the corresponding amount, as well as the regional variability affecting erosion rates at the watershed scale.

Cover Management Factor (C)

The cover management factor is a component that refers to the land cover in an area. This is a factor that emphasizes the influence of any type of cover on the impact of precipitation on the surface of the soil. The C factors per land cover for this study are taken from different sources, such as David (1988) and USDA-SCS (1972). These values were utilized as numerical values, which are inputs for the biophysical table. There are ten cover types identified in the Talomo River watershed with different C-factor values adapted from various authors. The C-factor values indicate the impact of vegetation and its potential to influence erosion rates. Of the ten vegetation types, it identified open/barren with the highest c-factor value of 1, indicating minimal ground cover, which increases the likelihood of erosion when subjected to extreme rainfall, particularly in areas identified as high elevation within the study area. Moreover, low c-factor values are built inland, considering a high number of pavements and permanent infrastructure, reducing the likelihood of erosion. On the other hand, the tendency for erosion in inland water is low, but it can accommodate alluvial deposits.

Table 2. Analyzed rainfall erosivity of Talomo River Watershed.

Class Number	Class Description	Area (ha)	%
1	Very Low	990.02	4.89
2	Low	1077.65	5.33
3	Moderate	2414.87	11.94
4	High	2926.80	14.47
5	Very High	12822.64	63.30
Total		20232.00	100.00

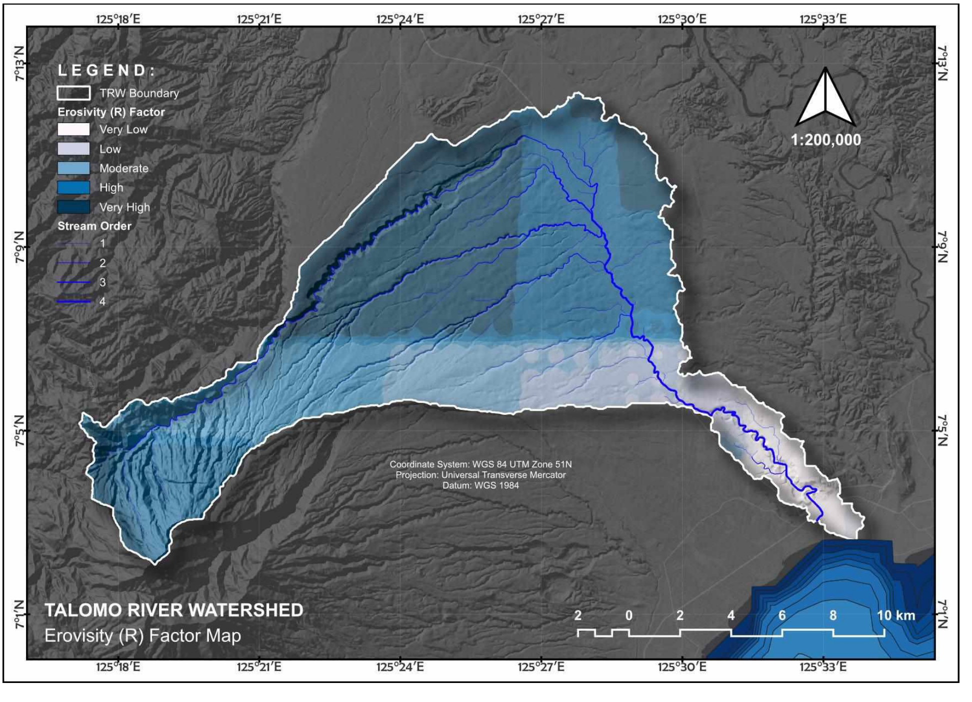

Figure 4. Erosivity (R) factor map of Talomo River Watershed.

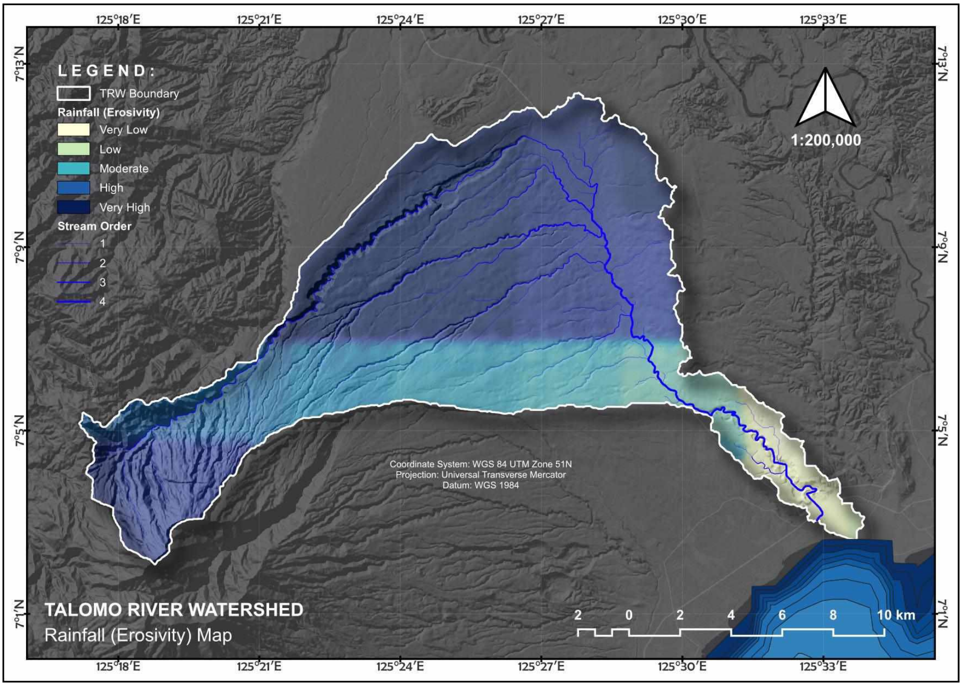

Figure 5. Rainfall factor map of Talomo River Watershed.

Conservation Practice Factor (P)

The conservation factor and management are critical in managing soil erosion at a watershed scale. As potentially influenced by elevation and rainfall, the conservation factor is an important element that controls erosion. In terms of conservation practices, it considers various p-factor values based on land classifications. As presented in Table 4. the agricultural classifications adopted a p-factor value in reference to slope percentage, which identifies a slope percentage of 50-100 as the highest p-factor value with 0.33. This indicates that support practice and effective and efficient soil erosion management practices are required to reduce the likelihood of erosion. This also considers that steeper slopes generally have higher chances of accelerated soil erosion due to their topography requiring increased conservation measures. Nonetheless, built and waterbodies with p-factor values closer to 1 require no immediate and preventive soil erosion practices considering no-erodible materials present due to their pave structure and stability.

Soil Erodibility Factor (K)

Erodibility is a component in the USLE equation that is heavily influenced by soil type. It measures soil susceptibility to erosion based on its physical and chemical properties. Thus, soil erodibility may vary for every soil type. Table 5. shows that 14523.53 hectares, or 71.79% of the soil type, are classified as San Manuel Silty Clay Loam soils. Andosols has the least amount of land at 128.95 hectares or 0.64% of the total land area. Clay types of soils are less susceptible to erosion because of their strong cohesive properties between particles (Sposito 2024). The K factor or soil erodibility values corresponding to its soil type are shown in Table 6. Clay soils are fine-textured soils that have low K factor values due to their properties and resistance to detachment. Silty clay soils are medium-textured soils that also have moderate K factor values because they are only moderately susceptible to detachment and runoff (USDA 2001). At the same time, mountain soils have high K factor values because they are in a mountainous area dominated by bedrock with low permeability. K-values represent erodibility; soil type is a critical factor in determining erodibility. Although andosols have the highest erodibility values, this only covers 0.64% of the Talomo River watershed, reducing the chances of a high erosion rate. On the other hand, the Talomo River watersheds are mostly composed of San Manuel Silty Clay Loam with 71.79%, which contains clay and is hard to erode due to its texture and classification, thus reducing the likelihood of erosion.

Table 3. Table showing the land cover types of Talomo River Watershed and its corresponding C Factor value.

Vegetation Cover	C-Factor Values	Reference
Closed Forest	0.003	David, 1988
Open Forest	0.006	David, 1988
Mangrove Forest	0.004	David, 1988
Brush/Shrubs	0.15	David, 1988
Open/Barren	1	USDA-SCS, 1972
Grassland	0.4	David, 1988
Annual Crop	0.25	David, 1988
Perennial Crop	0.3	David, 1988
Built-up	0	USDA-SCS, 1972
Inland Water	0	USDA-SCS, 1972

Table 4. Table showing the land use category of Talomo River Watershed, its slope class, and its corresponding P Factor value.

Land Use Classifica-tions	Slope Percentage	P-Factor Value	Reference/s
Agricultural	0 – 5	0.1	Wischmeier & Smith (1978)
	5 – 10	0.12	
	10 – 20	0.14	
	20 – 30	0.19	
	30 – 50	0.25	
	50 – 100	0.33	
Other lands (Forest, Shrub, Grassland, Barren)	All	1	
Built-Up Areas and Water Bodies	All	1	

Table 5. Table showing the soil classification of Talomo River Watershed.

Values	Soil Description	Area (ha.)	%
1	Matina Clay	4994.08	24.69
2	Andosols	223.53	1.10
3	San Manuel Silty Clay Loam	14523.53	71.79
4	Andosols	128.95	0.64
5	Tugbok Clay	360.26	1.78
	Total	20230.34	100.00

Table 6. Soil erodibility factor of Talomo River Watershed base on its soil type.

Soil Classification	Soil Type	K-Factor Value
Matina Clay	Clay	0.13
Andosols	Mountainous Land	0.49
San Manuel Silty Clay Loam	Silty Clay Loam	0.28
Andosols	Mountainous Land	0.49
Tugbok Clay	Clay	0.13

Table 7. Table showing the slope classification of Talomo River Watershed.

Value	Slope Ranges	Description	Area (ha)	%
1	0-3%	Level or Nearly Level	17352.44	86.32
2	3-8%	Gently Sloping to Undulating	1608.68	8.00
3	8-18%	Undulating to Rolling	788.98	3.92
4	18-30%	Rolling to Moderately Steep	291.69	1.45
5	30-50%	Steep	51.60	0.26
6	>50%	Very Steep	9.74	0.05
		Total	20103.13	100.00

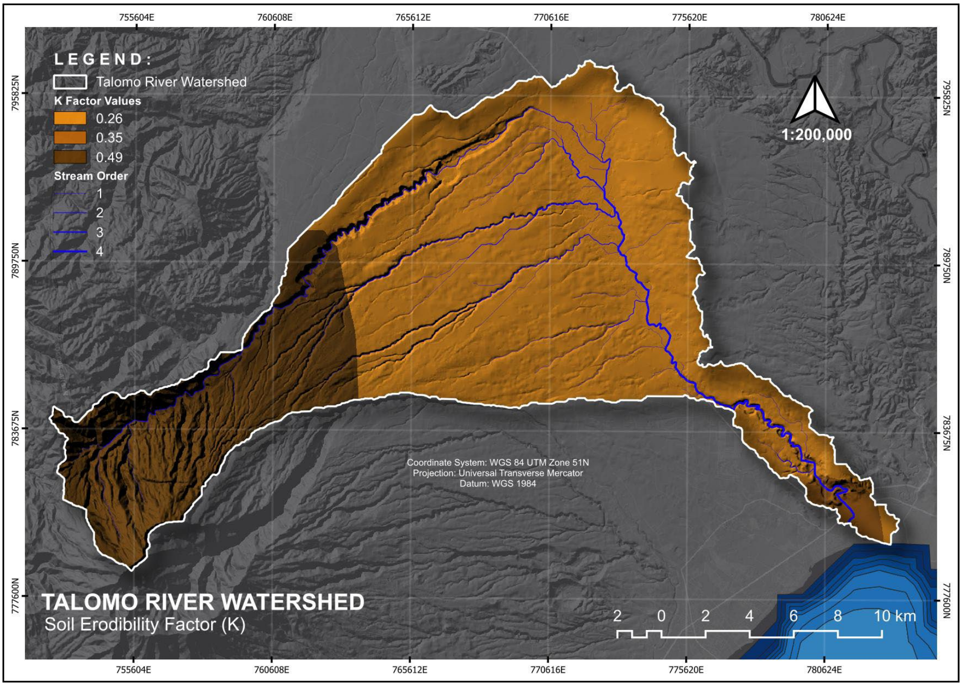

Figure 6. Erodibility (K) factor map of Talomo River Watershed.

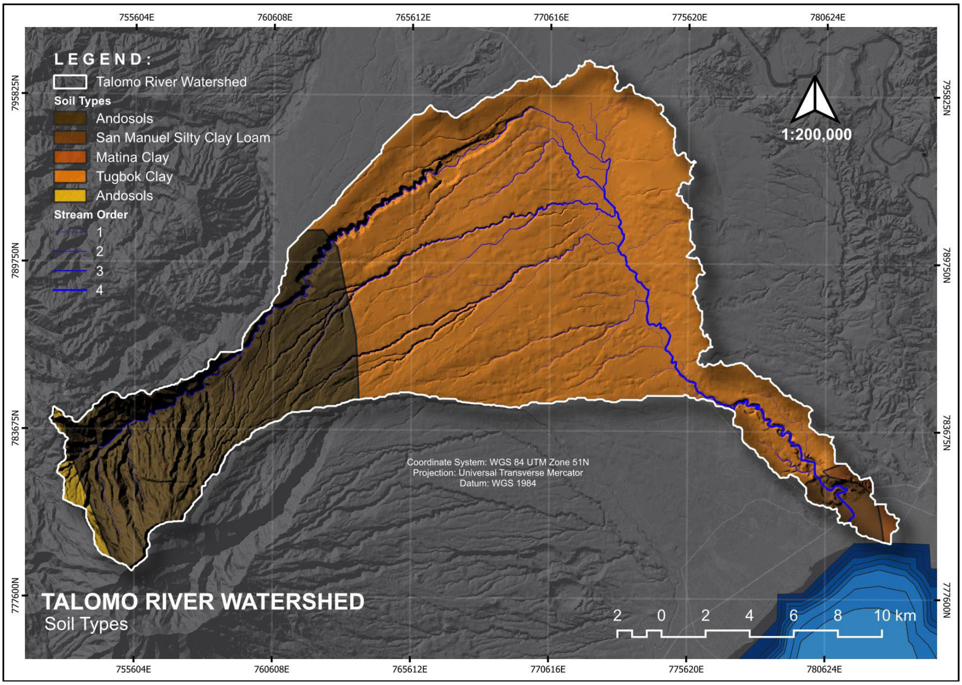

Figure 7. Soil types map of Talomo River Watershed.

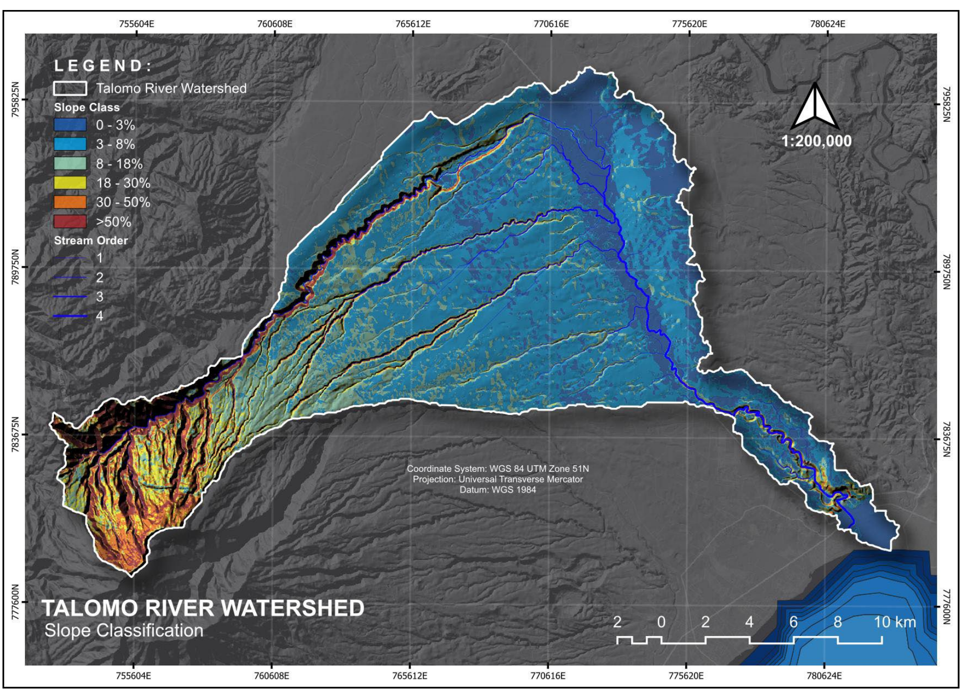

Figure 8. Slope classification map of Talomo River Watershed.

Slope Length and Steepness Factor (LS)

This factor is calculated based on the DEM of the area. Slope class classification is based on the Philippine Slope Classification, as shown in Figure 8. According to the data in Table 7., the slope class of level to nearly level has the highest area, which is 17,352.44 hectares and is 86.32% of the total area. The very steep slope class has the lowest area with 9.74 hectares and is 0.05% of the total area. This further shows that the degree of steepness can also influence the rate of erosion, as shown in Figure 8. This implies that higher elevations are classified as very steep and are observed near the edge of the watershed. This is because that part of the watershed is located near mount Apo, which naturally features steep slopes. Steeper slopes experience a higher rate of erosion, which causes increased sedimentation in areas with lower elevations. On the other hand, the Talomo River watershed is classified as level to nearly level, which may indicate less erosion.

Estimating Sediment Delivery Ratio

Sediment Export

In terms of exported sediments of the Talomo River watershed, the InVEST model results have computed 691556.42 tons/ha/year. This shows further that areas with high sediment export are observed in areas with higher elevations and near streams, which relates to the influence of topographic variation in sediment export and how water flow can influence sediment transport. Moreover, Table 8. is the computed sediment delivery ratio of the Talomo River watershed based on soil erosion parameters in different land classifications. This shows further that, among land classifications, open/ barren land has the highest sediment export, 512.94 tons/ha./year, and the least is mangrove areas, with 0 tons/ha./year. This implies that barren areas are more prone to sediment export, which can be linked to lower vegetation cover, reduced moisture content, and organic matter that holds soil particles together. On the other hand, mangrove is considered 0 sediment, which can be associated with its lower elevation that reduces the potential movement of erosion as export may related to elevation and slope gradient. Results from studies have shown that land cover can cause in relation to soil erosion (Negese 2021). In contrast, mangrove forests and closed forests have lower sediment export rates because they have natural barriers to protect them against soil erosion factors. Vegetation stabilizes the soil, and these land covers have root systems that help hold the soil together. In addition, mangrove areas act as buffers to help prevent sediments from entering streams.

Table 8. Table showing the sediment export per land cover types in Talomo River Watershed.

Land Class Description	Sediment Export per Land Classes (tons/ha./year)
Closed Forest	0.004
Open Forest	0.07
Mangrove Forest	0
Brush/Shrubs	44.54
Open/Barren	512.94
Grassland	116.97
Annual Crop	7.95
Perennial Crop	14.07
Built-up	0.054
Inland Water	42.59

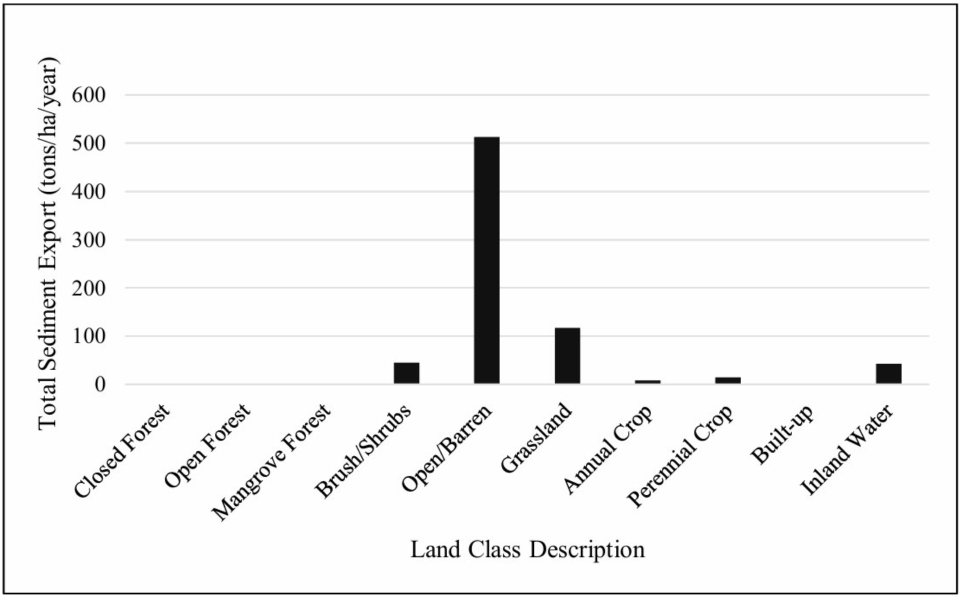

Figure 9. Graph showing the sediment export per land cover in Talomo River Watershed.

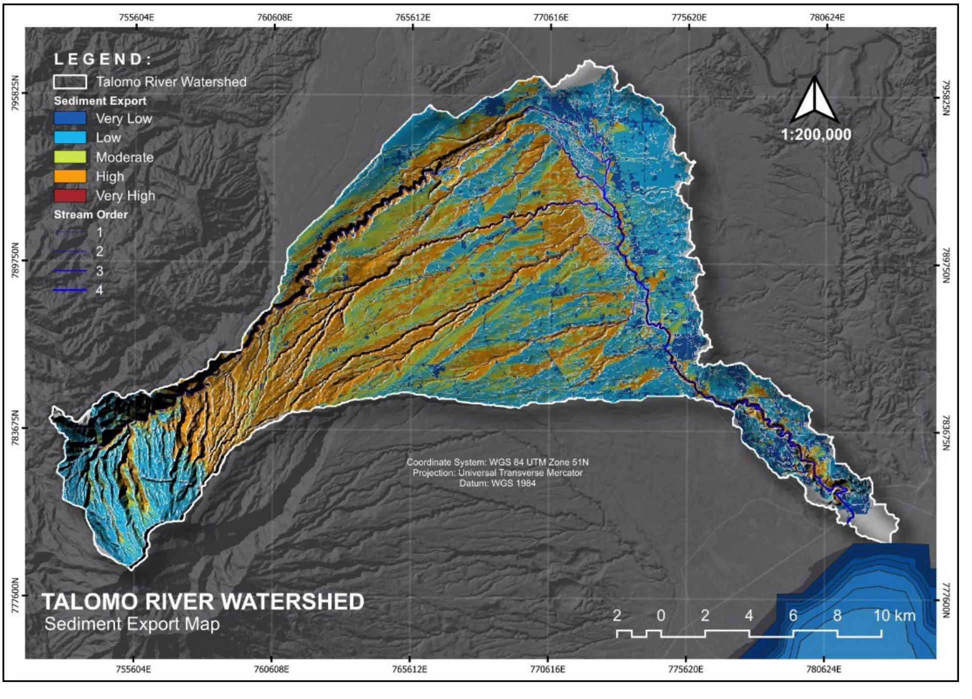

Figure 10. Sediment export map of Talomo River Watershed.

Sediment Deposition

The total sediment deposited from the Talomo River Watershed is 110,422,364.7 tons/ha/year. This implies that areas with high sediment deposition are observed in areas near streams. This indicates further how soil is detached from higher elevations and deposited in the downstream areas. The InVEST model has computed various sediment deposition rates based on different land classifications. Results have identified inland water with the highest sediment deposition, with 16503.76 tons/ha/year. This may indicate that most of the sediment is deposited near the stream as alluvial deposits due to soil erosion from the upland areas. The soil disturbance in various land classes can be attributed to accelerated sediment deposition in the lower areas. Moreover, the mangrove forest has the least amount of sediment deposited, which is 0, followed by built-up, with a deposition rate of 222.70 tons/ha/year. The presence of impervious surfaces in built-up areas explains why there is no sediment deposition, wherein it limits infiltration and reduces the tendency of sediments to settle. Aside from that, mangrove areas experience tidal fluctuations causing sediments to resuspend and not settle in the seabed.

Table 9. Table showing the sediment deposition per land cover types in Talomo River Watershed.

Class Description	Sediment Deposition per Land Class
Closed Forest	342.51
Open Forest	493.69
Mangrove Forest	0
Brush/Shrubs	6544.68
Open/Barren	8864.94
Grassland	4847.11
Annual Crop	3213.57
Perennial Crop	2010.75
Built-up	222.70
Inland Water	16503.76

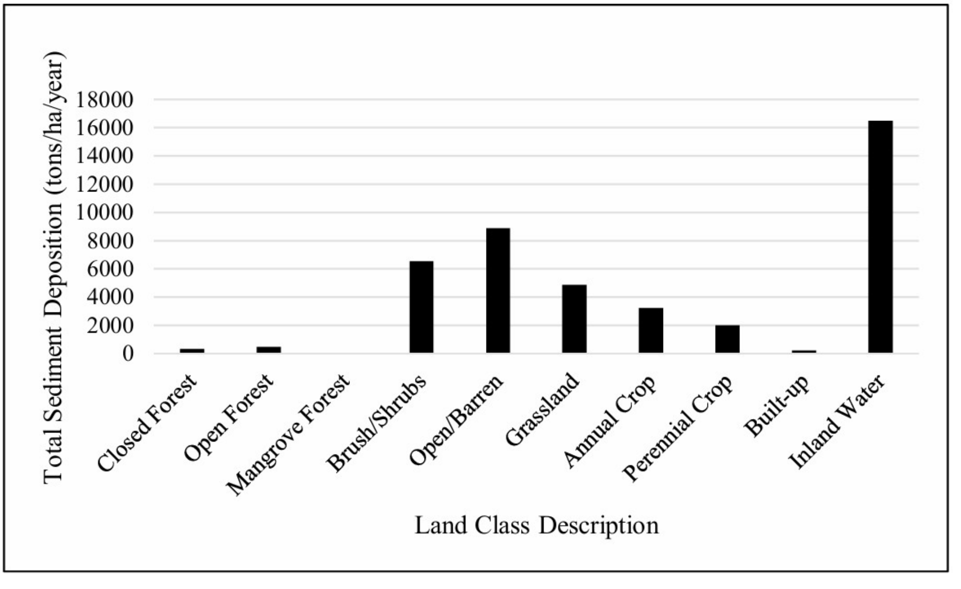

Figure 11. Graph showing the sediment deposition per land cover in Talomo River Watershed.

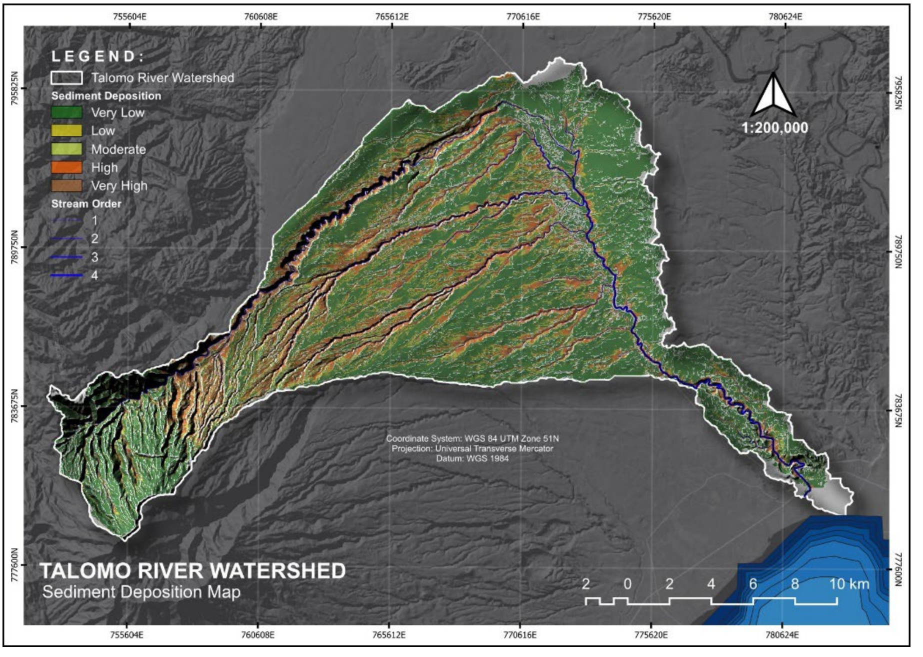

Figure 12. Sediment deposition map of Talomo River Watershed.

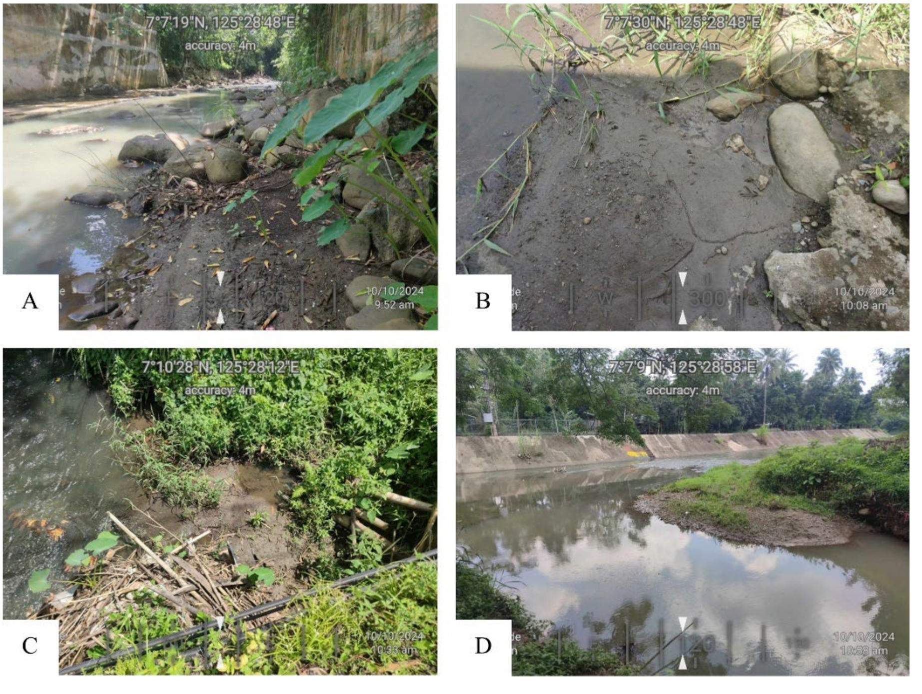

Figure 13. Figures showing the alluvial deposits in Talomo River Watershed; *A – Alluvial deposits in site 1, *B – Alluvial deposits in site 2, *C – Alluvial deposits in site 3, and *D – Alluvial deposits in site 4.

Figure 14. Figures showing Sand and Gravel Facilities near the river in Talomo River Watershed; *A – Sand and gravel facilities in site 1, *B – Sand and gravel facilities in site 2, *C – Sand and gravel facilities in site 3, and *D – Sand and gravel facilities in site 4.

Avoided Erosion

In terms of avoided erosion, the Talomo River watershed has a computed avoided erosion of 96,633,170.46 tons/ha/year. The high avoided erosion indicates large areas experiencing erosion at an accelerated rate. Avoided erosion depends on the potential soil loss that could occur in the area, which means that having a high amount of potential soil loss also results in a high amount of avoided erosion (Hooftman et al. 2023). It was observed that areas in the Talomo River watershed with high avoided erosion are at higher elevations, which can be attributed to the presence of vegetation, moisture, and potential organic matter content, reducing the tendency of soil erosion as compared to those in bare soil as presented in Figure 13. Moreover, built-up potentially accelerates erosion rather than preventing it due to reduced vegetation and soil compaction, which decreases soil infiltration capacities (Marondedze & Schütt 2020). Information about areas with high avoided erosion can contribute to strategically planning conservation methods that enhance vegetation and promote proper soil management.

Avoided Export

Figure 14 shows the total avoided export of Talomo River Watershed, which is 242,878,6371.96 tons/ha/year. This can be attributed to a higher coverage of existing vegetation in the area. The high avoided sediment export indicates lesser sediment in a watershed scale. Nonetheless, the avoided sediment export can be attributed to various factors such as cover management and improvement of land cover, which reduces the likelihood of sediments being eroded by water or wind. This implies that vegetation and other geological and hydrological parameters are preventing sediments from reaching the streams and being exported into downstream areas. Furthermore, this emphasizes the capability of the Talomo River watershed to retain its water quality as sediments do not reach the streams due to the vegetation holding it. This also indicates how the watershed retains its sediments. Higher values indicate a higher capacity of the watershed to retain sediments (Ureta et al. 2022)

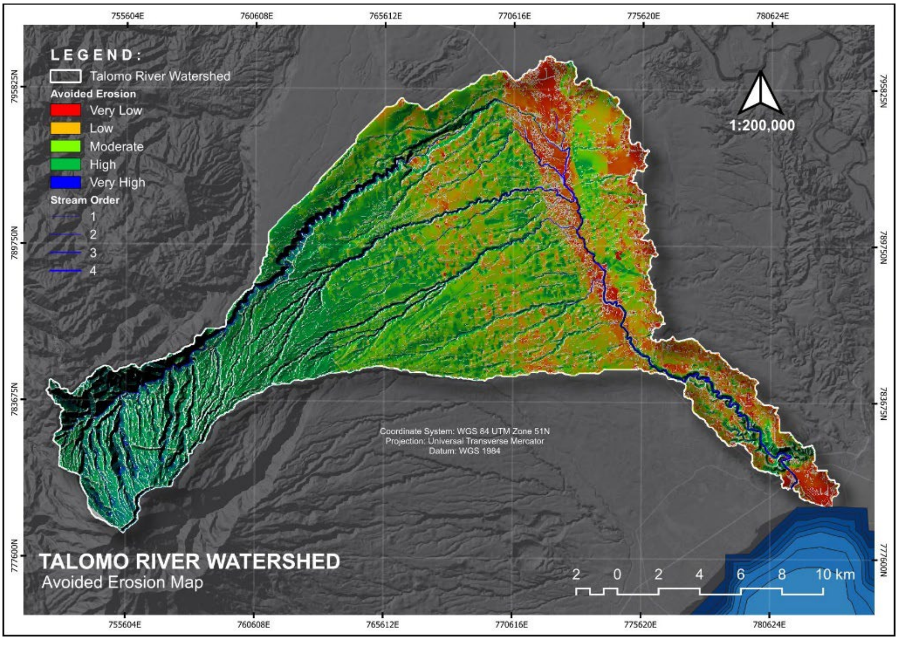

Figure 15. Avoided erosion map of Talomo River Watershed.

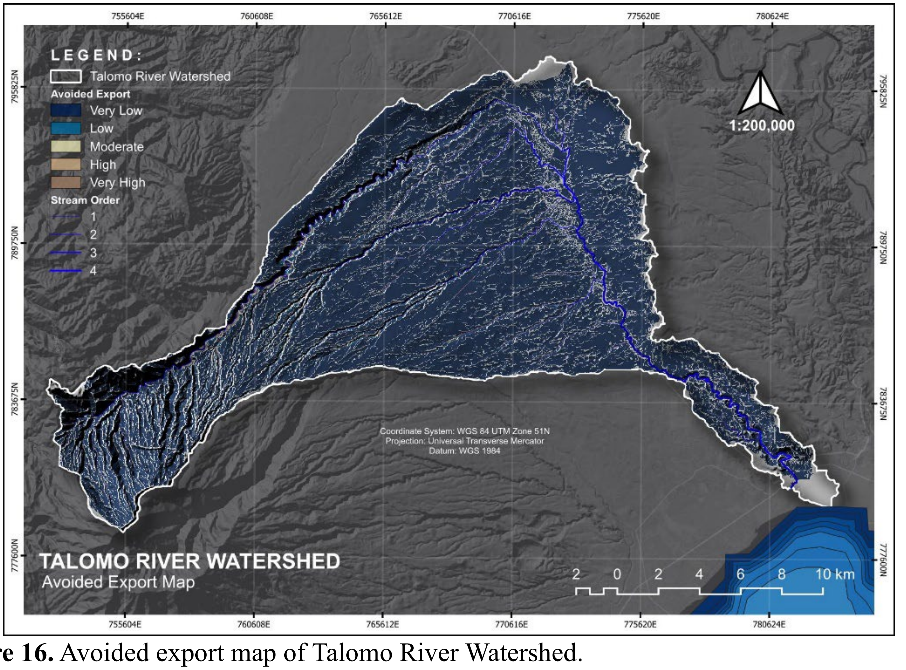

Figure 16. Avoided export map of Talomo River Watershed.

Potential Soil Loss

Presented in Table 10. is computed potential soil loss (Fig. 17. Fig. 18) in the Talomo River watershed based on the different land cover types as depicted in Figures 15 and 16. Data have revealed that potential soil is coming from barren/ open land with 643595.62 pixels/ton/year. This implies that the majority of the sediment eroded and deposited may be attributed to the presence of barren land. Although it only accounts for 0.03% of the total land area with 17.75 ha. This implies that the likelihood of barren being eroded is high considering other variables like climate, slope, soil type, and human activities. On the other hand, the lowest potential soil loss is mangroves, with 130.86 pixels/ton/ year. This indicates that mangroves could hold sediments and forms as soil, resulting in a reduction of soil loss. Aside from those, mangroves dominated in inundated areas, making them resilient to water-driven erosions.

Table 10. Potential soil loss based on land cover types in Talomo River Watershed.

Class ID	Class Description	Area (Ha)	Area (%)	Potential Soil Loss (pixel/tons/year)
1	Closed Forest	2990.87	4.45	1254476.32
4	Open Forest	16504.87	24.58	4482877.35
7	Mangrove Forest	4.53	0.01	130.68
10	Brush/Shrubs	4748.85	7.07	36550548.01
13	Open/Barren	17.75	0.03	643595.62
14	Grassland	387.34	0.58	11392484.96
16	Annual Crop	1667.48	2.48	3014738.00
17	Perennial Crop	28746.96	42.82	56082404.99
20	Built-up	11931.82	17.77	461939.33
21	Inland Water	140.34	0.21	459351.86
	Grand Total	67140.87	100.00	114342547.10

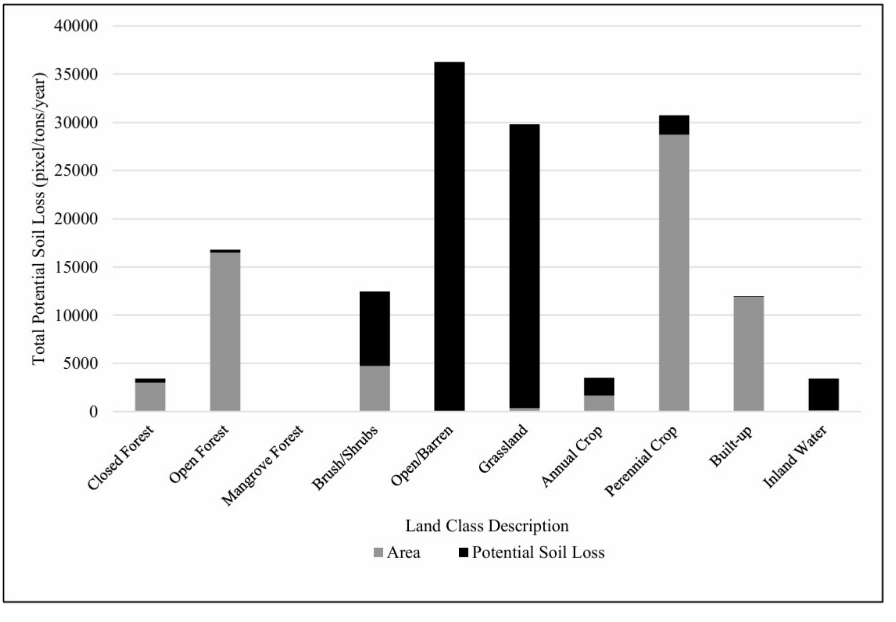

Figure 17. Graph showing the potential soil loss in Talomo River Watershed.

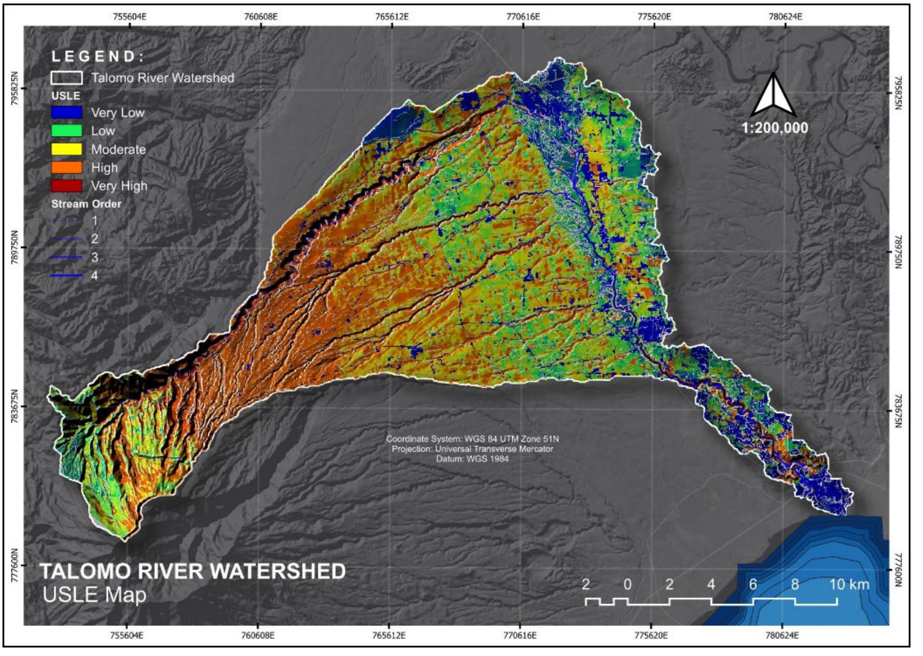

Figure 18. Map showing the potential soil loss map of Talomo River Watershed.

CONCLUSION

The variables influencing sediment yield and sediment lost are the rainfall erosivity factor, cover management factor, conservation practice factor, soil erodibility factor, and slope length and steepness factor. Findings from the study have revealed that in terms of rainfall erosivity, it is described as very high, with 63.30% or 12,822 ha. A high amount of rainfall in the area increases its susceptibility to soil erosion, especially in areas with less land cover (Zhao et al. 2021). In terms of cover management factor C, it shows that the watershed has a minimum value of 0. On the other hand, it has a maximum value of 1. The cover management factor determines how vegetation may affect the area in terms of erosion. The value of 0 indicates areas with sufficient ground cover, reducing the chances of erosion. On the other hand, a value of 1 indicates minimal ground cover. The highest conservation factors are forest, shrub, grass, barren land, built-up, and water bodies, with a P-factor of 1. At the same time, the lowest conservation factor is 0.1, which is classified as agricultural land. The conservation factor determines how effective the conservation practices applied in the area. Values closer to 1 require no immediate and preventive soil erosion practices. The soil classifications in the watershed are mostly San Manuel Silty Clay Loam, which covers 71.79% of the total area, and the least is Andosols, with 1.10% or 223.53 ha. San Manuel Silty Clay Loam has high clay content and is hard to erode due to its texture and classification, thus reducing the likelihood of erosion. For its slope ranges, it is classified as level to nearly level with 86.32% with slope ranges from 0-3% with a total land area of 17,352.44 ha. This may indicate less erosion in the area based only on its slope classification.

The sediment delivery estimates have computed 691,556.42 tons/ha/year of sediment export, with the highest from open/ barren land and the lowest for mangroves with 0 and built-up with 0.054 tons/ha/year. For sediment deposition, it has a total of 110,422,364.7 tons/ha/year, with the highest from inland waters with the value of 16,503.76 tons/ha/year and the lowest from mangrove forest and built-up area with 222.70 tons/ha/year. It has an avoided erosion of 96,633,170.46 tons/ha/year, avoided export of 2,428,786,371.96 tons/ha/year, and the highest potential loss of 643,595.62 pixel/tons/year from barren/open land, and the least is from mangrove forest cover classification with 130.68 pixel/tons/year. This shows that the Talomo River watershed is at risk for potential large quantities of sediment loss based on its soil erosion parameters. At least 10 gravel facilities within the watershed are established 5 meters from the main river, increasing soil disturbance and detachment. This makes the areas more likely to experience sedimentation and siltation. With this problem, it is recommended to establish 30 to 50 meters of riparian buffers along the rivers, which would help prevent detached sediments from depositing along the riverbanks. Moreover, high potential soil loss results in high sedimentation at the estuaries, with alluvial deposits accumulating in the area, exacerbating the issues of sedimentation and siltation. To help mitigate, it is recommended that critical areas where high sedimentation occurs be identified and necessary measures devised. Furthermore, local government units are recommended to develop watershed-based management programs to improve sediment retention and soil health.

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