

DETERMINATION OF SEDIMENT LOAD CHANGES (1983-2010) AT
TERENGGANU RIVER CATCHMENT USING REMOTE SENSING AND
GEOGRAPHIC INFORMATION SYSTEM (GIS) TECHNOLOGY

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SCHOOL OF MARINE AND ENVIRONMENTAL SCIENCES
UNIVERSITI MALAYSIA TERENGGANU

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TERENGGANU RIVER CATCHMENT USING REMOTE SENSING AND
GEOGRAPHIC INFORMATION SYSTEM (GIS) TECHNOLOGY**

By

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**Research Report submitted in partial fulfillment of
the requirements for the degree of
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**DECLARATION AND VERIFICATION REPORT
FINAL YEAR RESEARCH PROJECT**

It is hereby declared that and verified that this research report entitled Determination of Sediment Load Changes (1983 – 2010) at Terengganu River Catchment using Remote Sensing and Geographic Information System (GIS) Technology by Chong Wei Sheng Matric No. UK27672 have been examined and all errors identified have been corrected. This report is submitted to the School of Marine and Environmental Sciences as partial fulfilment towards obtaining the Degree Bachelor of Science (Marine Science), School of Marine and Environmental Sciences, Universiti Malaysia Terengganu.

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LIST OF ABBREVIATIONS

ArcSWAT	-	ArcView Soil and Water Assessment Tool
SWAT	-	Soil and Water Assessment Tool
GIS	-	Geographic Information System
HRU	-	Hydrological Response Unit
DEM	-	Digital Elevation Model
GPS	-	Global Positioning System
°C	-	Degree Celcius
m/s	-	Meter per second
SSC	-	Suspended Sediment Concentration
%	-	Percentage
a.m.	-	Morning
p.m.	-	Afternoon or evening
mg/L	-	Milligrams per liter
mm	-	millimeter
g	-	Gram
.txt	-	Text file (Notepad)
DID	-	Drainage and Irrigation Department
E	-	East
N	-	North
.shp	-	Shape file
USGS	-	United States Geological Survey

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ABSTRACT

Sediment movement from land or sediment load, into rivers and settle at the river mouth or coastal area can create enormous effect on environment and any activity related. Thereby, the sediment load study is needed to understand better on the sedimentation and erosion process at a catchment. In this study, ArcView Soil and Water Assessment Tool (ArcSWAT) model had been used to estimate sediment load at the Terengganu River catchment (approximately 440000 hectares). For better prediction, there are several parameters that had been taken consideration such as rainfall, soil type, land use, surface elevation, and river network of the catchment. All the weather data ranged from 1980 until 2010 daily data were obtained from Drainage and Irrigation Department (DID) of Malaysia and Meteorology Department (MET) Malaysia. In-situ SSC at 2 stations: Station 1 at river mouth and Station 2 at upper stream had been analyzed (2.2.2015 to 5.2.2015) in order to test correlation relationship with simulated sediment load result from ArcSWAT. Before that, the created SWAT model had validated its accuracy prediction with observed daily river flow and sediment load DID 2008 data, both showed strong relationship in river flow (correlation coefficient (R^2) 0.822, Nash-Sutcliffe Model Efficiency (NSE) 0.772) and sediment load (R^2 0.753, NSE 0.585) respectively. Furthermore, the results showed high correlation between simulated and in-situ river flow (R^2 0.8234 Station 1 and R^2 0.9357 Station 2), simulated sediment load and in-situ suspended sediment concentration (SSC) (0.9953 Station 1 and 0.9332 Station 2) respectively. 34 sub-basins, 924 Hydrological Response Units (HRUs), 9 United States Geological Survey (USGS) land use classes and 10 soil classes had been identified in the Terengganu River catchment. Forest-Evergreen (FRSE) (69.55%) the highest land use and STEEPLAND (62.10%) is the highest soil type class

in the catchment. The model was further used for determination of sediment load 1980 until 2010. The model was applied to predict future sediment load from 2017 until 2030, the highest is on 2030 (48660000 tonnes) and the lowest is on 2022 (36550000 tonnes). In sum, ArcSWAT model can be used to study sediment load in a catchment that many environmental factors may influence the sediment load, Soil and Water Assessment Tool (SWAT) model (Geographic Information System (GIS) technology) is easy to handle and more economic if compared to ground sampling for a long sampling period. Future study also can include 5 years different land cover maps of the catchment to study the land use effect on sediment load in 5 year time frame and in-situ sampling sites can be increased within the catchment area.

**KAJIAN TERHADAP PERUBAHAN JUMLAH SEDIMEN DARI TAHUN
1983 SEHINGGA 2010 DALAM KAWASAN TADAHAN SUNGAI
TERENGGANU DENGAN MENGGUNAKAN TEKNOLOGI PENDERIAAN
JARAK JAUH DAN *GEOGRAPHIC INFORMATION SYSTEM (GIS)*.**

ABSTRAK

Pergerakan sedimen daripada daratan dan mendap ke dalam muara sungai atau kawasan persisiran pantai boleh membawa kesan kepada alam sekitar. Oleh itu, kajian terhadap jumlah hasil mendapan atau sedimen boleh menyumbangkan ilmu dalam pemahaman proses sedimentasi dan hakisan dalam sebuah kawasan tadahan. Dalam kajian ini, ArcSWAT model telah digunakan untuk meramal jumlah sedimen dalam kawasan tadahan Sungai Terengganu (beranggaran 440000 hektar). Selain itu, terdapat beberapa elemen diperlukan untuk menaikkan prestasi ramalan model seperti maklumat hujan, jenis tanah, kegunaan tanah, ketinggian permukaan tanah dan jaringan sungai dalam kawasan tadahan. Semua maklumat cuaca yang digunakan adalah dari tahun 1980 sehingga 2010 maklumat harian perolehi daripada Jabatan Pengairan dan Saliran (JPS) dan Jabatan Meteorologi Malaysia. Penyampelan SSC di 2 stesen: stesen 1 di muara sungai manakala stesen 2 di pertengahan aliran sungai (2.2.2015 sehingga 5.2.2015) telah dianalisis untuk menguji ujian statistic korelasi perhubungan dengan keputusan simulasi ArcSWAT. Sebelum itu, model SWAT yang dibina telah uji keberkesanan ramalan dengan maklumat kelajuan aliran sungai dan jumlah sedimen harian 2008 daripada JPS, kedua-duanya menunjukkan korelasi yang tinggi dalam kelajuan aliran sungai (R^2 0.822, NSE 0.772) dan jumlah sedimen (R^2 0.753, NSE 0.585). Di sampling itu, keputusan analisis menunjukkan korelasi tinggi antara keputusan kelajuan aliran sungai simulasi dan in-situ (0.8234 stesen 1 dan 0.9357 stesen 2), manakala keputusan

jumlah sedimen simulasi dan in-situ (0.9953 stesen 1 dan 0.9332 stesen 2). 34 sub-basin, 924 HRU, 9 USGS kelas kegunaan tanah dan 10 jenis kelas tanah telah didapati dalam kawasan tadahan Sungai Terengganu. FRSE (69.55%) adalah kelas kegunaan tanah paling tinggi manakala STEEPLAND (62.10%) adalah jenis kelas tanah yang paling tinggi. Model tersebut digunakan juga untuk meramal jumlah sedimen dari tahun 2017 sehingga 2030, dan keputusan menunjukkan 2030 (48660000 ton) adalah paling tinggi manakala paling rendah adalah 2922 (36550000 ton). Secara konklusinya, model ArcSWAT boleh digunakan untuk kajian jumlah sedimen dalam sebuah kawasan tadahan yang dipengaruhi oleh banyak faktor. Model SWAT mudah dikendalikan dan tidak kos tinggi seperti pengambilan sampel untuk jangka masa yang panjang. Akhir sekali, kajian masa datang mungkin boleh menggunakan peta kawasan 5 tahun berbeza untuk mengkaji kesan perubahan penggunaan tanah terhadap jumlah sedimen dalam kawasan tadahan dan jumlah kawasan penyampelan in-situ boleh ditambah dalam kawasan tadahan.