Spatial Modeling for Soil Erosion in Chay Basin, in Vietnam

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Objectives

- Survey physical conditions in the Chay Catchments
- Establish GIS database
- Assessment soil erosion potential in the study area

The study area (Chay catchments)

- Vietnam has 3/4 of the area is upland, so soil loss by erosion is a serious problem in this country
- Chay basin has total of 408,729.6 ha
- It stretch out from the high mountain and plateau areas to the low hill land in the Northern of Vietnam. It's lie down in upland area, and belongs to Hagiang, Laocao, Yenbai and Phutho provinces

METHOLOGY AND METHODS

- **Catchment's approach**
- **Universal Soil Loss Equation**
- **Using GIS tools**

Catchment's approach

- Both soil and water resources were threatened by soil erosion and sediment redistribution
- The catchments approach tries to find out the relationships between soil loss with hydrological system and other conditions in the catchments
- The proposals based on these relationships to control the soil loss and protected water resource, particular to control impact of the sediment

Universal Soil Loss Equation apply for Chay Catchment

A = R.K.L.S.C.P

A represents the potential long term average annual soil loss in tons per acre per year. This is the amount, which is compared to the "tolerable soil loss" limits.

R is the rainfall and runoff factor by geographic location

K is the soil erodibility factor

LS is the slope length-gradient factor; L is the length of the slope steepness, its unit is m; and S is slop angle, its unit is radian

C is the crop/vegetation and management factor

P is the support practice factor

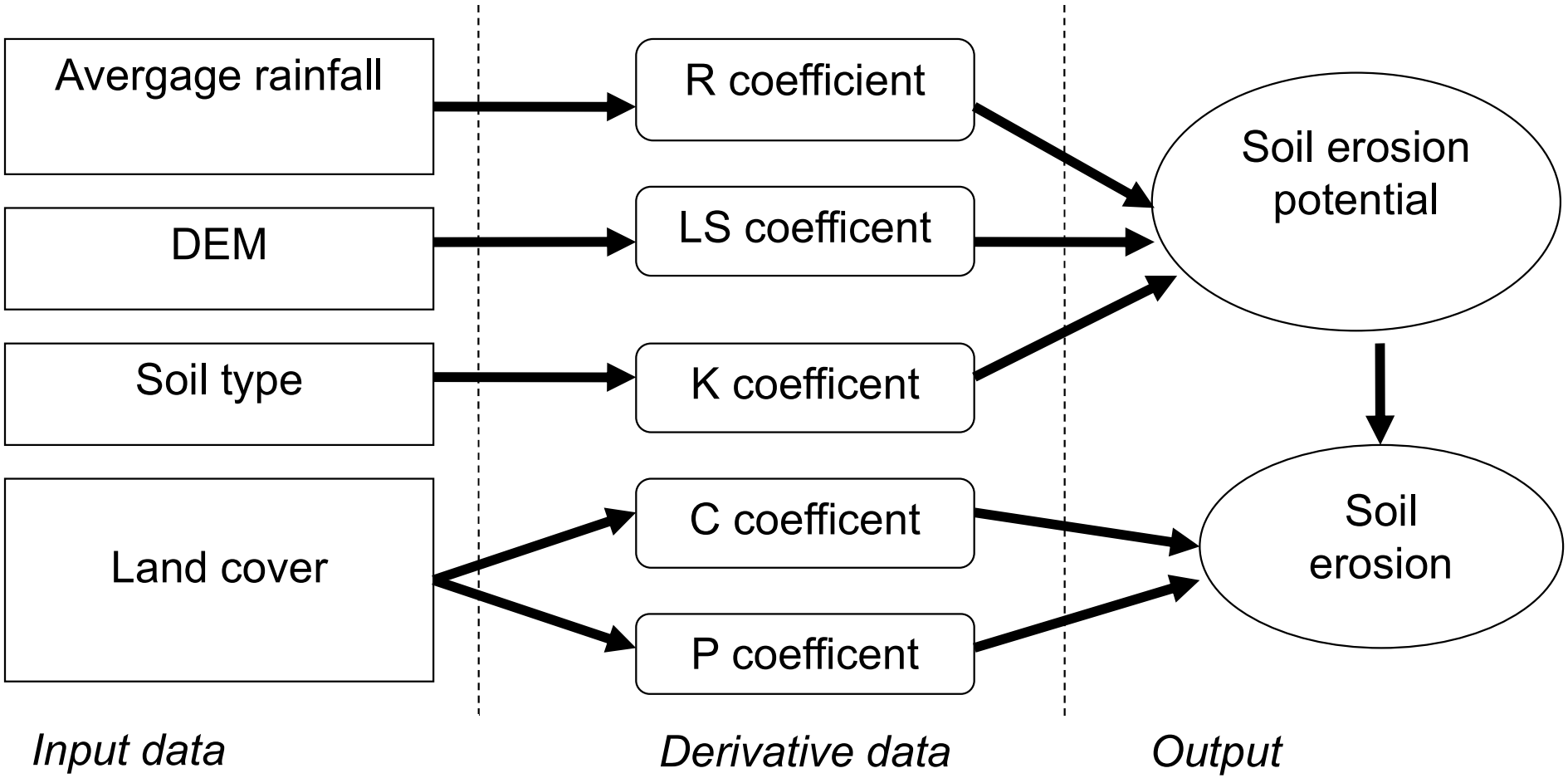
(This research concentrated on the soil loss potential so the C and P coefficients aren’t calculate

GIS database

The database of the soil erosion assessment are include data types, they are following

- Topological data
- Hydrological system
- Rainfall
- Soil map
- Auxiliary data: They are land-use/cover; administrative and catchments boundary, etc.

Spatial analysis tools and running USLE model in GIS software

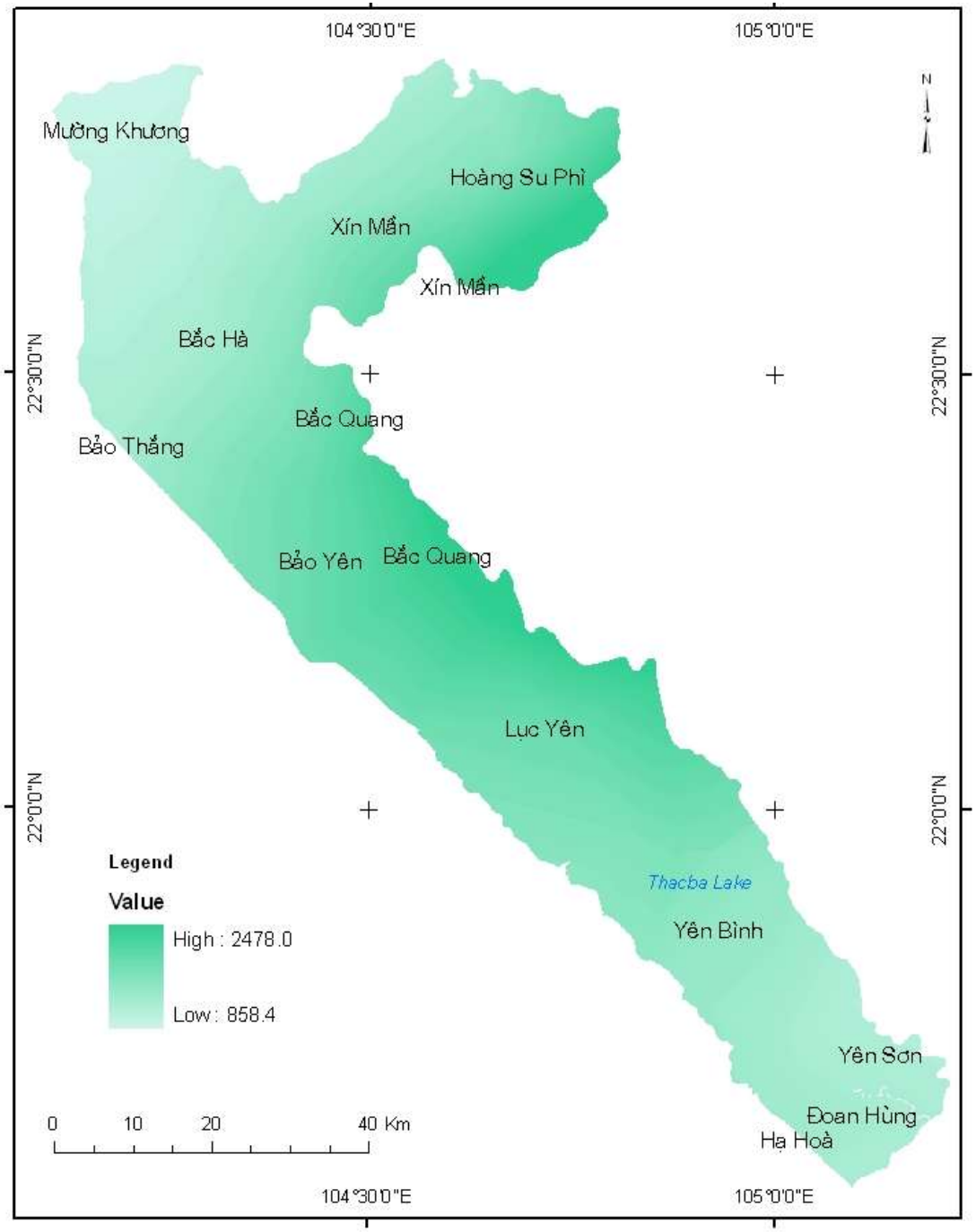


Processing carrying out of USLE module in GIS

SOIL EROSION POTENTIAL AND DISCUSSION

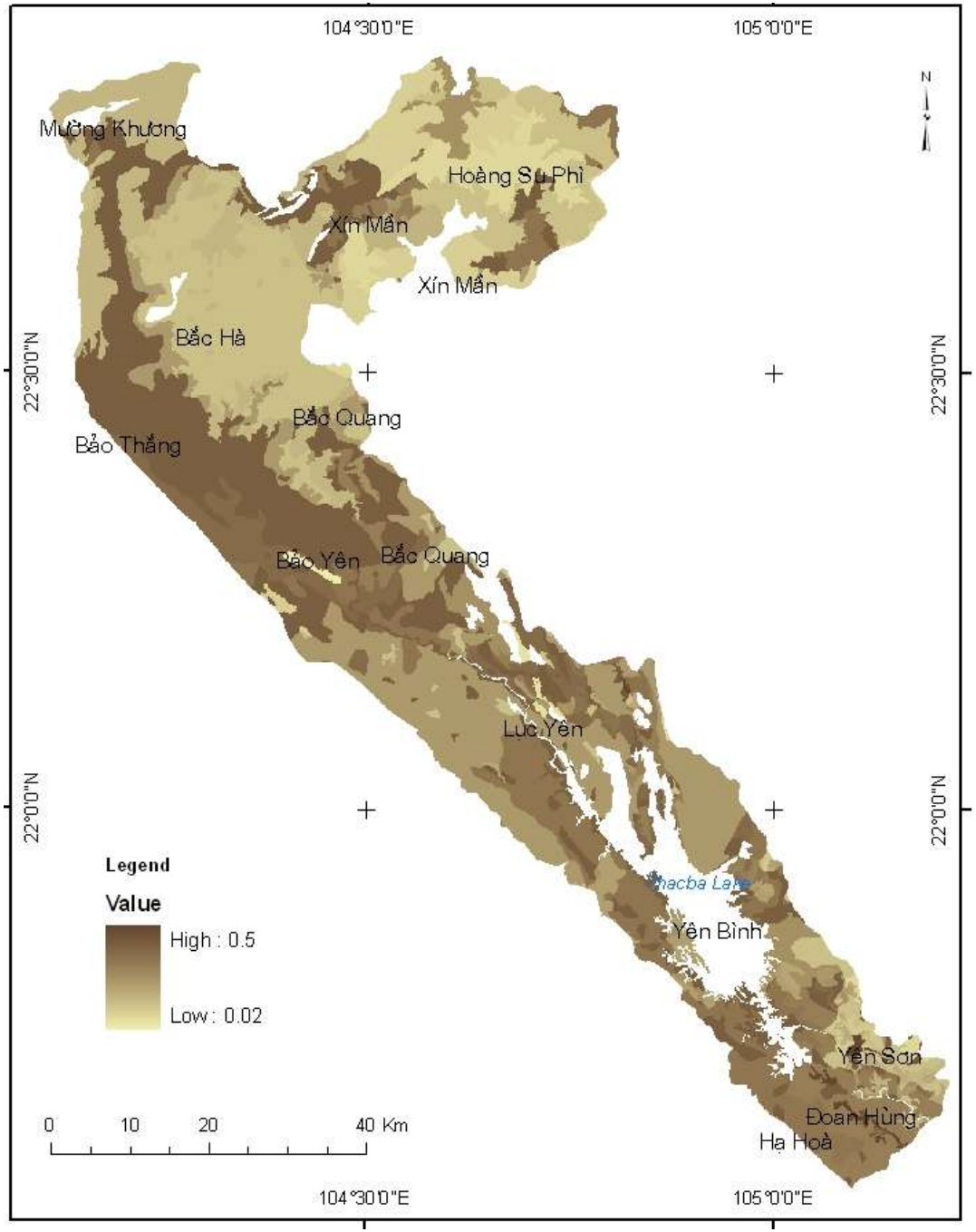
The coefficient of R factor in the Catchment's Chay

Weather stations	Average rainfall (mm/year)	R ceofficient
Hà Giang	2430.1	1224.4
Hoàng Su Phì	1814.4	899.0
Bắc Hà	1737.5	858.4
Lào Cai	1764.4	872.6
Bắc Quang	4802.1	2478.0
Yên Bái	2106.9	1053.6
Phú Hộ	1850.0	917.8
Lục Yên	2076.5	1037.5
Tuyên Quang	1641.4	807.6



K factor and its coefficient are high affect to the soil erosion in the Catchments Chay.

This factor is belong to the kind of the soil, including soil type, quality, structure, organic matter and permeability also contribute, and it is also high depended on the slop steep and the length of slope steepness



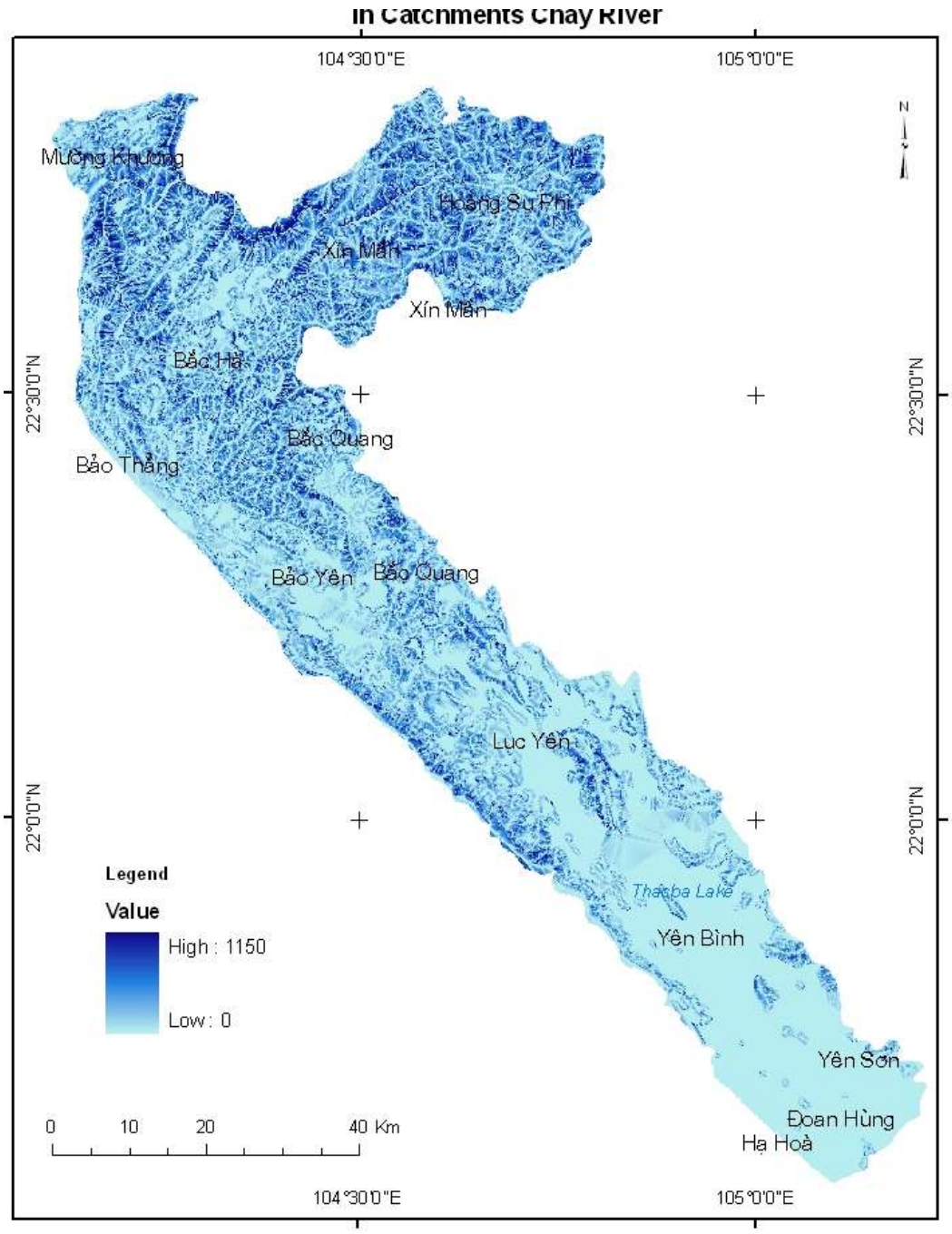
The coefficient of K factor of the soil erodibility

No	Soil type (Vietnamese)	Soil Symbol	Soil type FAO-UNESCO	Ký hiệu	Coefficent of K factor	Area (ha)	% total area
I	**Nhóm đất phù sa**	**P**	**Fluvisols**	**FL**		**1936,2**	**0,41**
1	Đất phù sa không được bồi	P	Eutric Fluvisols	FLe	0.30	585,9	0,12
2	Đất phù sa chua	Pc	Dystric Fluvisols	FLd	0.23	1350,3	0,29
II	**Đất glây**	**GL**	**Gleysols**	**GL**		**3354,5**	**0,71**
3	Đất glây	GL	Eutric Gleysols	GLe	0.38	2068,8	0,44
4	Đất glây chua	GLc	Dystric Gleysols	GLd	0.50	1285,7	0,27
III	**Đất đen**	**R**	**Luvisols**	**LV**		**1617,2**	**0,34**
5	Đất đen glây	Rg	Gleyic Luvisols	LVg	0.12	916,1	0,19
6	Đất đen cacbonnat	Rv	Calcic Luvisols	LVk	0.03	701,1	0,15

IV	**Đất xám**	**X**	**Acrisols**	**AC**		**339701,5**	**72,30**
7	Đất xám cơ giới nhẹ	Xa	Areni Acrisols	Aca	0.39	1000,5	0,21
8	Đất xám feralit	Xf	Ferralic Acrisols	ACf	0.28	277601,5	59,09
9	Đất xám glây	Xg	Gleyic Acrisols	ACg	0.19	1248,1	0,27
10	Đất xám điển hình	Xh	Haplic Acrisols	ACh	0.14	14985,8	3,19
11	Đất xám mùn trên núi	Xu	Humic Acrisols	ACu	0.19	44865,7	9,55
V	**Đất đỏ vàng**	**F**	**Ferralsols**	**FR**		**83894,5**	**17,86**
12	Đất nâu đỏ	Fd	Rhodic Ferralsols	FRr	0.28	341,1	0,07
13	Đất nâu vàng	Fx	Xanthic Ferralsols	FRx	0.38	2178,5	0,46
14	Đất mùn vàng đỏ trên núi	Fh	Humic Ferralsols	FRu	0.20	81374,9	17,32
VI	**Đất mùn Alit núi cao**	**A**	**Alisols**	**AL**		**1654,2**	**0,35**
15	Đất mùn Alit núi cao	Ah	Humic Alisols	ALh	0.37	1654,2	0,35
VII	**Đất xói mòn trơ sỏi đá**	**E**	**Leptosols**	**LP**		**524,7**	**0,11**
16	Đất xói mòn trơ sỏi đá	Ec	Lithic Leptosols	LPq	0	524,7	0,11
	Tổng đất					***432682,8***	***92,10***

The coefficient of slope length-gradient factor

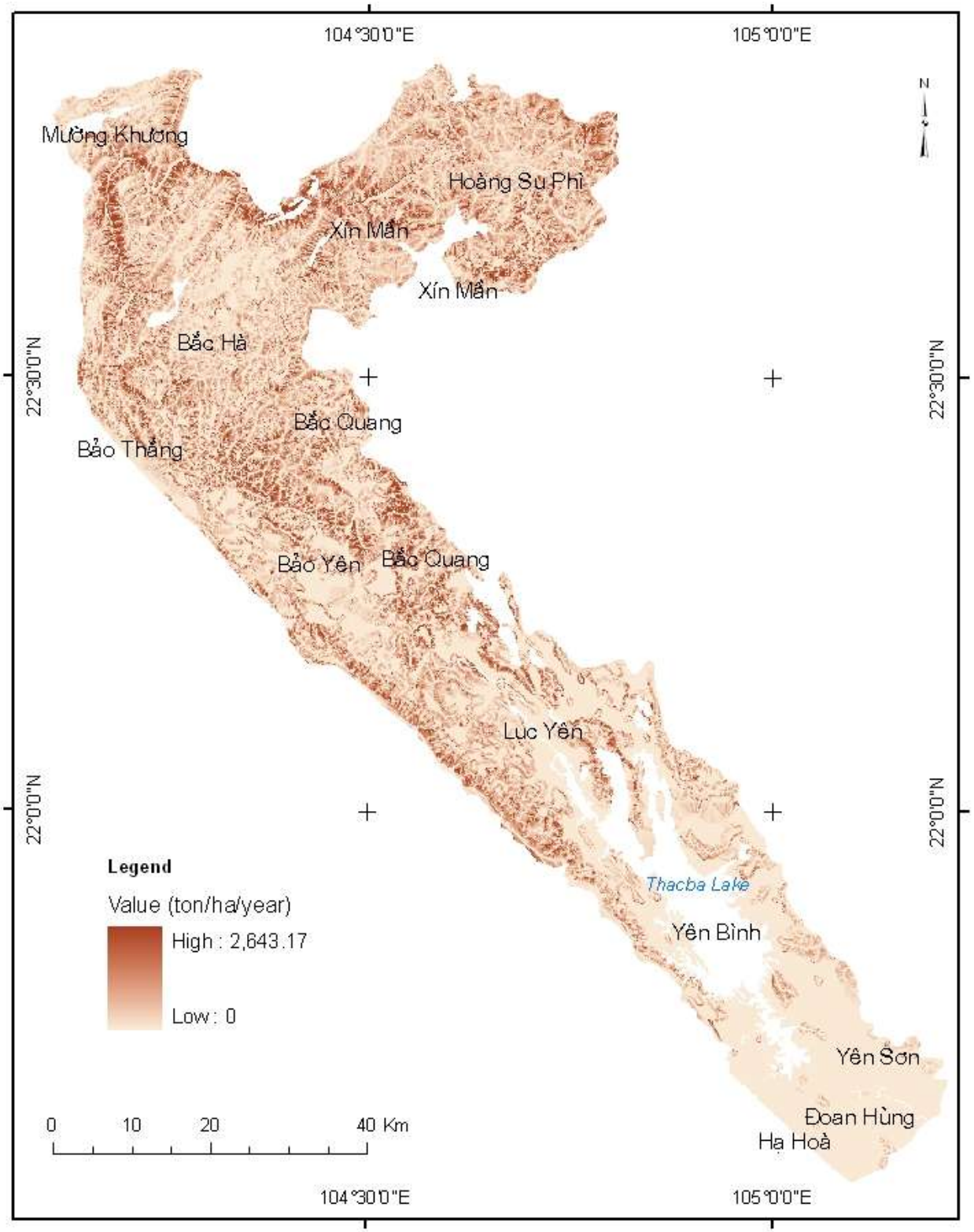
No.	LS	Area (ha)	% total area
1	0-5	260,571	55,46%
2	5-10	47,026	10,01%
3	10-20	84,756	18,04%
4	20-30	42,057	8,95%
5	30-40	17,311	3,68%
6	40-100	15,974	3,40%
7	100-500	2,068	0,44%
8	500-1150	59	0,01%
	Total	**469821,5**	**100.00**



Prediction of the soil erosion in the Chay Catchment

Degree of the soil loss potential	Amount of the soil loss potential (ton/ha/year)	The average of the amount of the soil loss potential (ton/ha/year)	Total of the amount of the soil loss potential (ton/year)	Area (ha)	% total area
Weak	< 100	4.16	927,222	214,038	49,47%
Medium	100 – 500	303.86	14,241,850	98,998	22,88%
Strong	500 – 1000	708.60	19,670,050	72,839	16,83%
Very strong	1000 – 1500	1,208.47	21,823,500	26,103	6,03%
Dangerous	> 1500	2,643.17	49,235,300	20,705	4,79%

Soil erosion potential in Chay Catchments



CONCLUSIONS AND RECOMMENDATIONS

- The catchments approach is suitable way for assessing the soil loss in the upland
- Application the Universal Soil Loss Equation (USLE) model in the GIS can be easily and quickly to obtain quality of the soil loss in each of the point in the study area. However, this module is requiring the true particular coefficients for each study area
- The soil loss potential in the Chay Catchment can be achieved by integrating the erosion factors (R, K and LS)