FIG WORKING WEEK 2017
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SPATIAL ANALYSIS OF SOIL EROSION AND ITS CORRELATION WITH LANDSLIDE EVENTS: CASE STUDY OF CIPONGKOR, WEST BANDUNG DISTRICT

Denny ***LUMBAN RAJA***
Adang ***SAPUTRA***
Johannes ***ANHORN***

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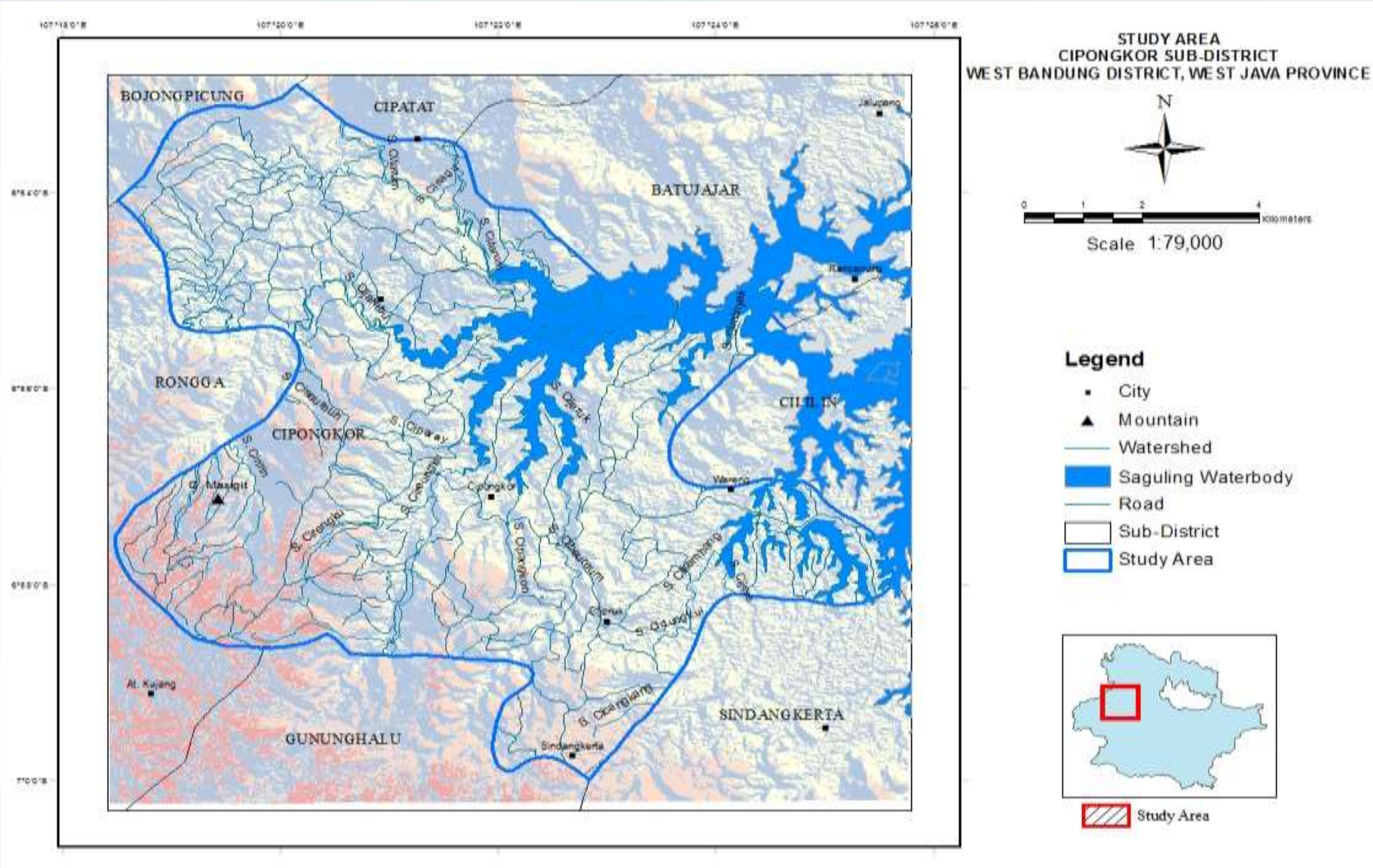
MAIN RESULTS

- Most of the surroundings of Cipongkor is dominated by very high soil erosion potential
- GIS is capable to give a visual impression of the main factors contributing to soil erosion
- Increasing soil erosion and haphazard human interventions at the study area leading to destabilized slopes do aggravate the potential for damaging large scale landslide events

BACKGROUND

- West Java Province in Indonesia is the region with the most frequent landslide occurrence, especially during the rainy season
- Cipongkor region is a mountainous landscape area. Medium to steep slopes are controlled by geological structures reflected by active faults, such as the Cimandiri and Lembang fault line. Fertile soils and thick weathering of rocks attracts people to live in the study area.
- The geological conditions, existing landuse (85% of agriculture and plantation), high rainfall, large soil thickness, and steep slopes support the occurrence of erosion and stimulate landslide occurrence.



Coordinate Area : 6°53’00” – 7°00’00” LS dan 107°18’00” – 107°26’00” BT

Methodology

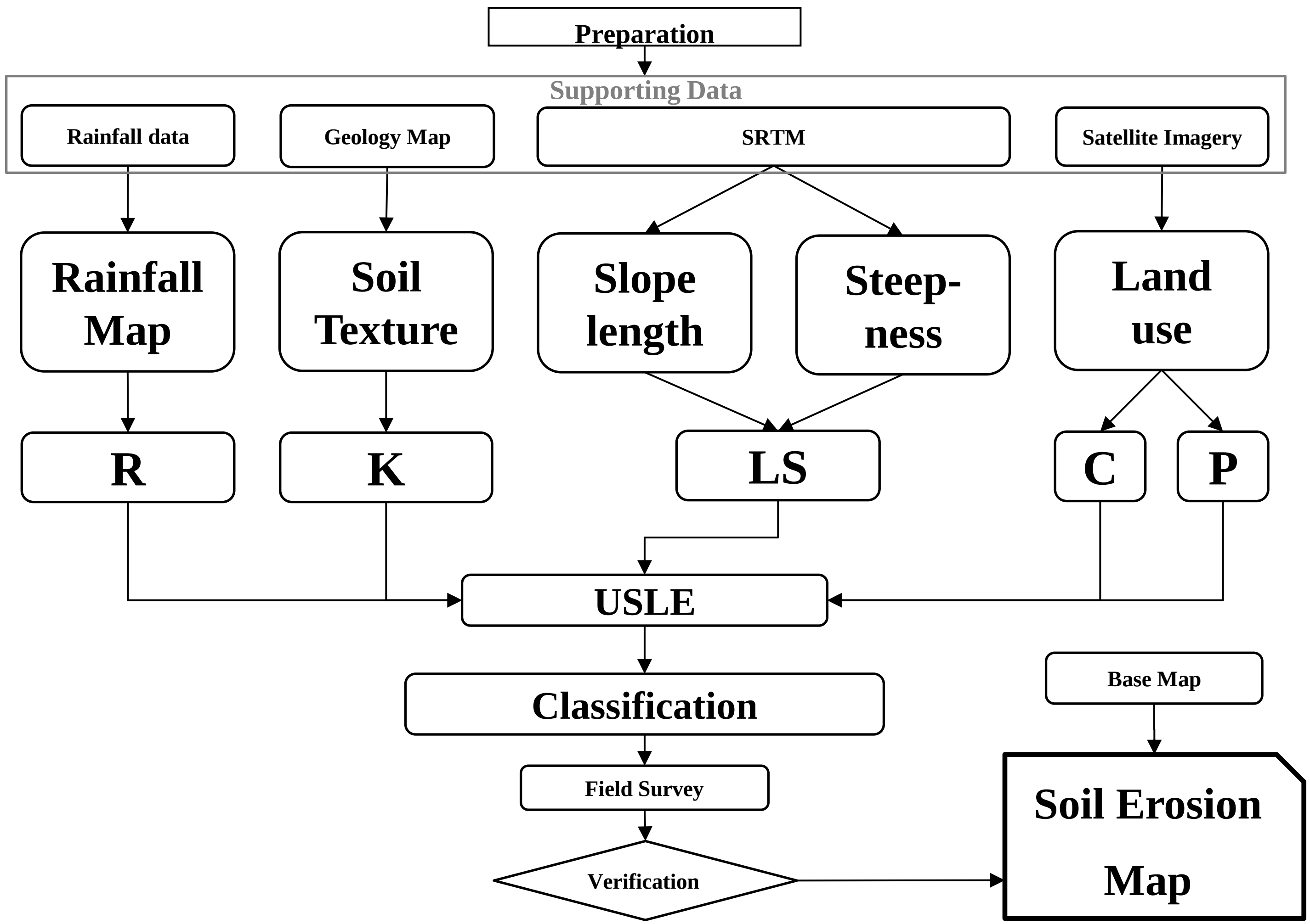
Erosion Potential
USLE Method
(A = R x K x LS x C x P)

Processing Data
GIS Method to determine the landslide potential zone

Data

DATA	SCALE	YEAR	SOURCE
SRTM	Res. 30 x 30	2012	USGS
Geological Map + Attribute	1 : 100.000	2005	Geological Agency
Landsat	1 : 100.000	2009	USGS
Landuse	1 : 50.000	2014	Geospatial Information Agency of Indonesia
Annual Rainfall	1 : 50.000	2012	Meteorology, Climatology, and Geophysics
Base Map	1 : 50.000	2014	Geospatial Information Agency of Indonesia

FLOW CHART OF METHODOLOGY



USLE methode was used to assess erosion risk

USLE Formula:

A = R x K x LS x C x P

where:

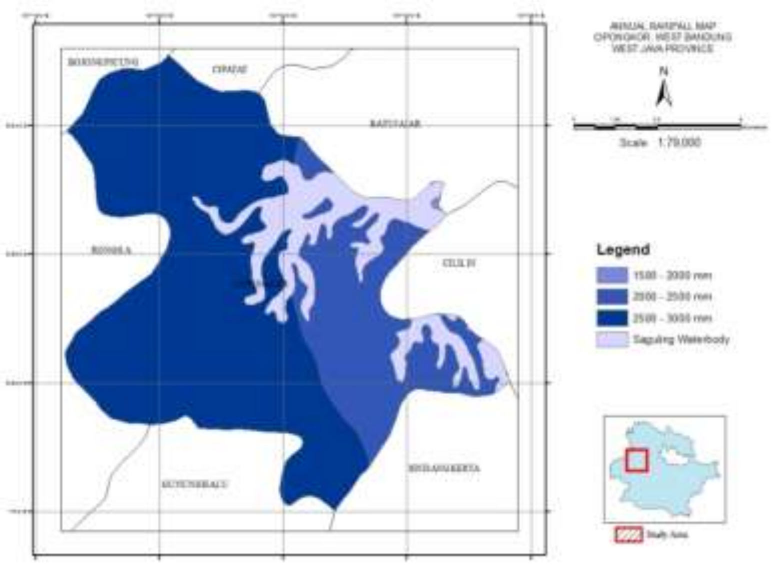
A	: represents the potential long term average annual soil loss in tons per hectare (ton/ha/yr);
R	: rainfall–runoff erosivity factor (mm/yr);
K	: soil erodibility factor (ton/ha);
LS	: slope length–steepness factor (dimensionless);
C	: crop management factor (dimensionless);
P	: is the land management practice factor (dimensionless).

USLE methode was used to assess erosion risk

Rainfall Index

EI_{30} is defined as the product of kinetic energy of rainfall and the maximum contiguous 30 minutes rainfall intensity during the rainfall event

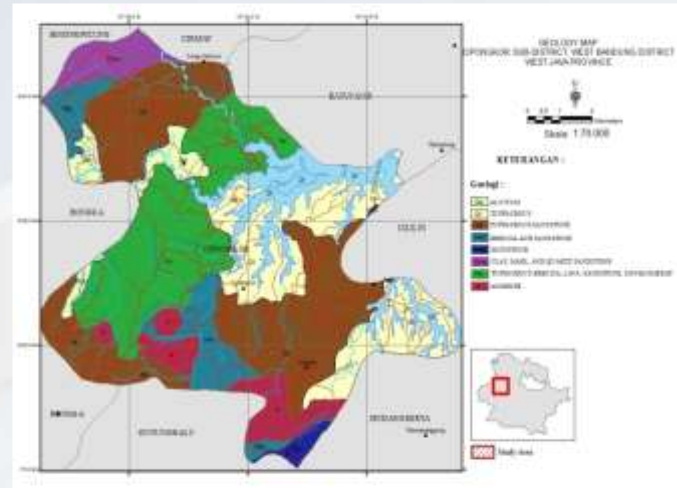
$$EI_{30} \text{ year} = 0{,}41 \times R^{1{,}09}$$



(Wiersum and Ambar 1979; in Ambar; 1986)

Soil erodibility index (K)

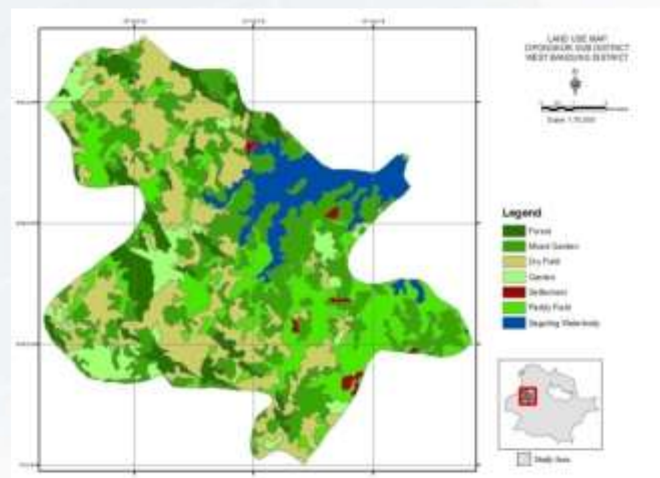
No	Soil Texture	K
1.	Clay	0,02
2.	*Loam* clay	0,04
3.	*Loam* sand	0,30
4.	Sillty	0,20
5.	Sandy	0,70



Crop- and vegetation cover index (CP)

(Ministry of Forestry, 1985)

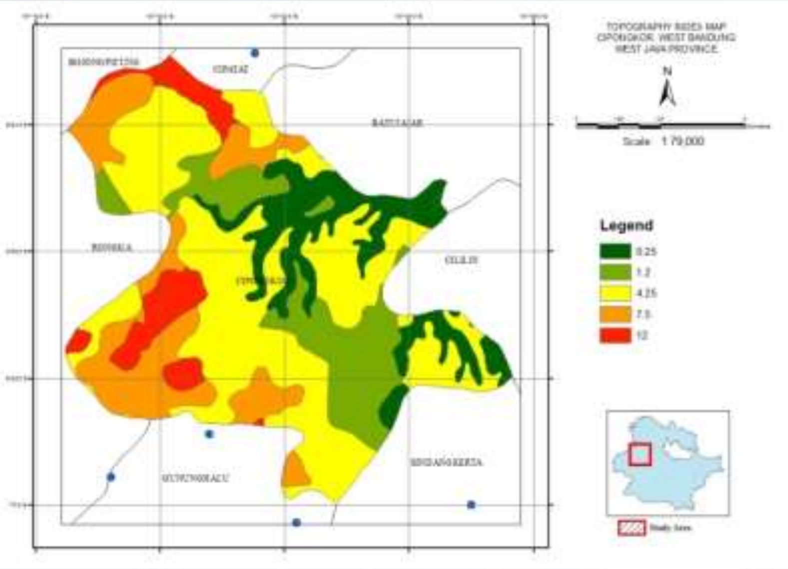
No	**Class name**	**CP**
1.	Settlement	0,60
2.	Mixed Garden	0,30
3.	Paddy Field	0,05
4.	Dry fields	0,75
5.	Garden	0,40
6.	Forest	0,03



Slope gradient and Slope Length Index (LS)

(Ministry of Forestry 1986)

No	Slope (%)	LS
1.	0 – 5	0,25
2.	5 – 15	1,20
3.	15 - 35	4,25
4.	35 - 50	7,50
5.	> 50	12,0



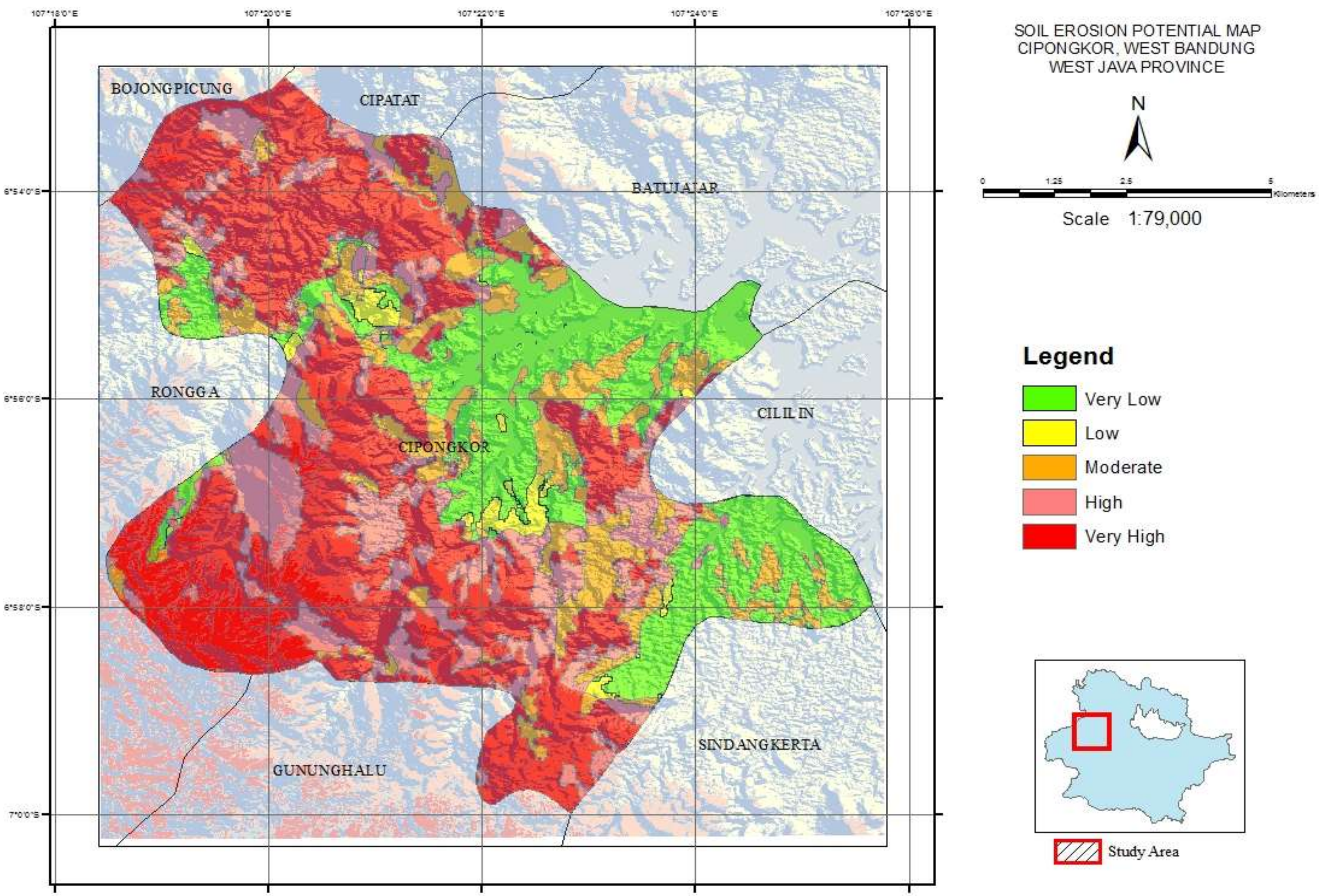
$$LS = Pow([FlowAcc]\ x\ \frac{resolution}{22.1\ x\ 0.6})\ x\ Pow\ (\frac{(\sin[slope\ gradient]\ x\ 0.001745)}{0.09\ x\ 1.3})$$

STUDY RESULT

Classification of erosion risk level
(Ministry of Forestry 1998)

No	Soil loss (ton/ha/th)	Class of Erosion	Erosion Level
1.	< 20	I	Very low
2.	20 – 50	II	Low
3.	50 – 250	III	Moderate
4.	250 – 1000	IV	High
5.	> 1000	V	Very high

STUDY RESULT



Points of Field Survey

No.	Lat	Long	Location	Geology	Slope
Ero-1	-6.99	107.320	Cilabodas Village	Breksi/Andesit	54º
Ero-2	-7.00	107.369	CicangkapGirang	Tuffa, Sand	65º
Ero-3	-7.00	107.416	Tugu Batas	Sand	40º
Ero-4	-6.95	107.342	M. Masigit	Andesit	45º
Ero-5	-6.96	107.342	BojongHaur	Tuffa	36º
Ero-6	-6.97	107.340	Sodong Village	Tuffa	43º
Ero-7	-6.92	107.349	Saguling Waterbody	Tuffa, Sand	60º
Ero-8	-6.89	107.358	Saguling Waterbody	Tuffa, Sand	60º
Ero-9	-6.89	107.334	Saguling Waterbody	Tuffa, Sand	60º

Erosion in the roadside
Village Saguling, Kec. Cipongkor

Massive landslides in the roadside
Cipongkor-Saguling

Conclusions

- Spatial modeling with GIS is capable to give a visual impression of the main factors contributing to soil erosion
- Most of the surroundings of Cipongkor is dominated by very high soil erosion potential.
- Human activity is one of the main factors affecting erosion potential in the study area.
- Increasing soil erosion and haphazard human interventions leading to destabilized slopes do aggravate the potential for damaging large scale landslide events.

Thank you