Modelling of Discharges and Sediment Transport in Terrace Paddy Fields Through SWAT Model. -A Case Study Of Keduang Sub-Watershed, Wonogiri Regency, Central Java, Indonesia -

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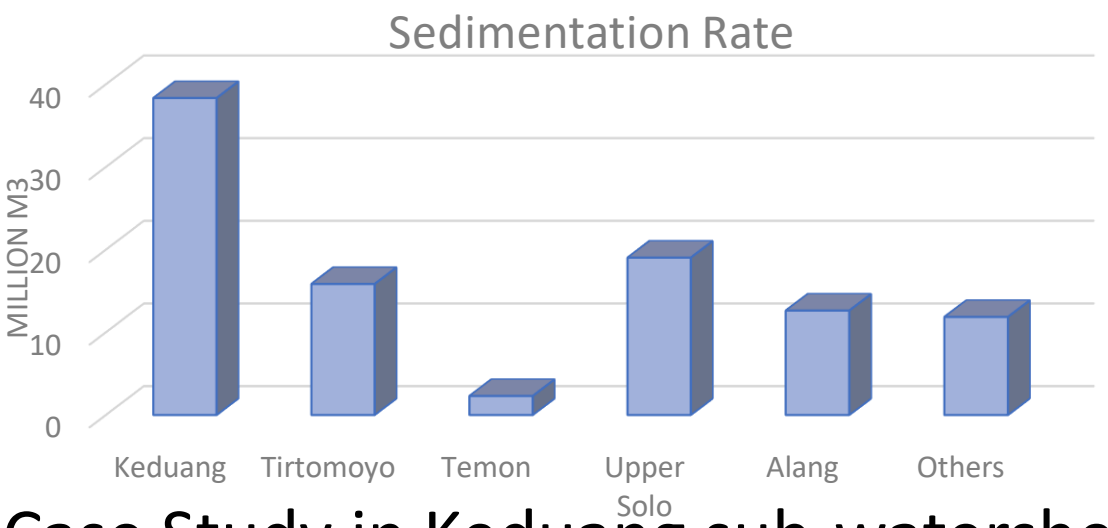
Outline

- INTRODUCTION
- OBJECTIVE OF THE STUDY
- MATERIALS AND METHHOD
- RESULT AND DISCUSSION
- CONCLUSION

Introduction



- Case Study in Keduang sub-watershed
  - Soil erosion rate in Keduang sub-watershed is seriously high JICA (2007),
  - Terraced paddy field (BIG,2000).
  - Relationship between sediment loss and terrace paddy fields

Introduction
- Model Application -

- Terraced field application (Nunes et al 2018)
- Sediment loss application, (Hallous et al, 2018)
- Effect of bench terrace,(Khelifa et a丨,2018)

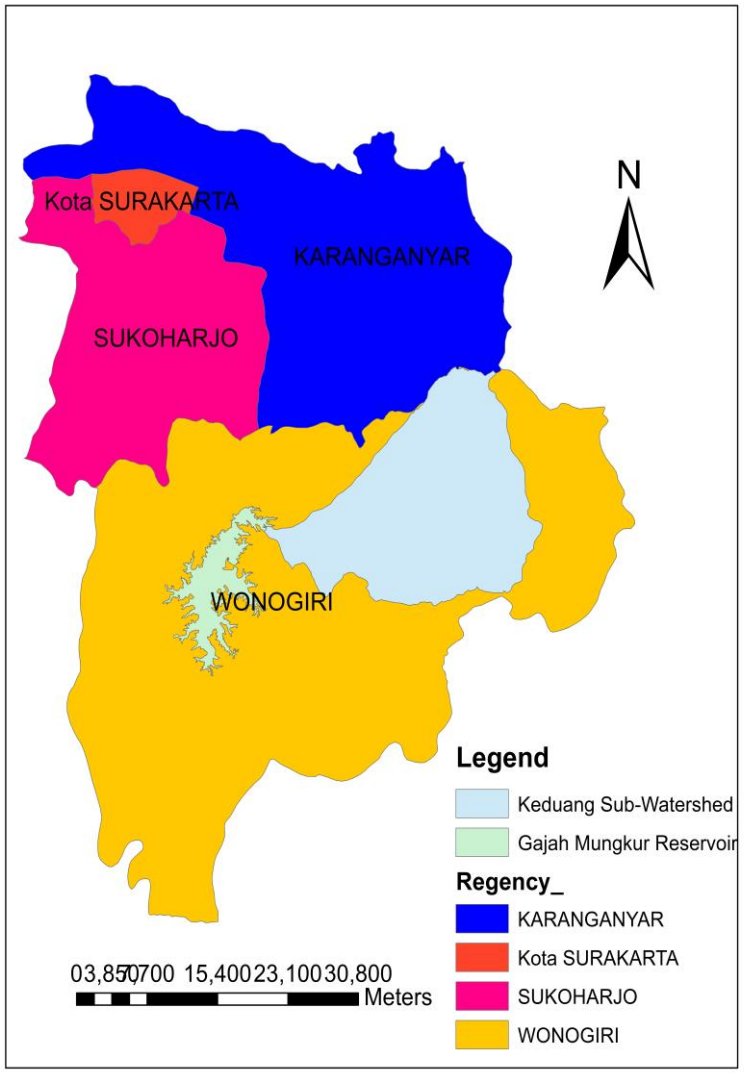
Objectives of the study :

1.To simulate discharges and sediment yield by using SWAT.

2.To evaluate the role of terraced paddy field in Keduang Sub-Watershed.

Materials and Method

STUDY AREA



- The climate characteristic of this area is commonly tropical monsoon.
- The average rainfall is about 2822 mm/year.
- The average annual temperature in the Keduang Sub-Watershed is 26^{o}C with maximum temperature is 34.33^{o}C, and minimum temperature is 14^{o}C.

What is SWAT?

R: Rainfall

Curve Number model

$$Q = \frac{(R - 0.2S)^2}{R + 0.8S}$$

$$S = \frac{1000}{CN} - 10$$

Surface Flow & Sediments

MUSLE model

$$Sed = 11.8.\ (Q_{surf}.\ Q_{peak}.area_{hru})^{0.56}.\ K_{USLE}\ .\ C_{USLE}\ P_{USLE}.\ LS_{USLE}.\ CFRG$$

Lateral Flow

Percolation

Ground Water Flow

Recharge deep aquifer

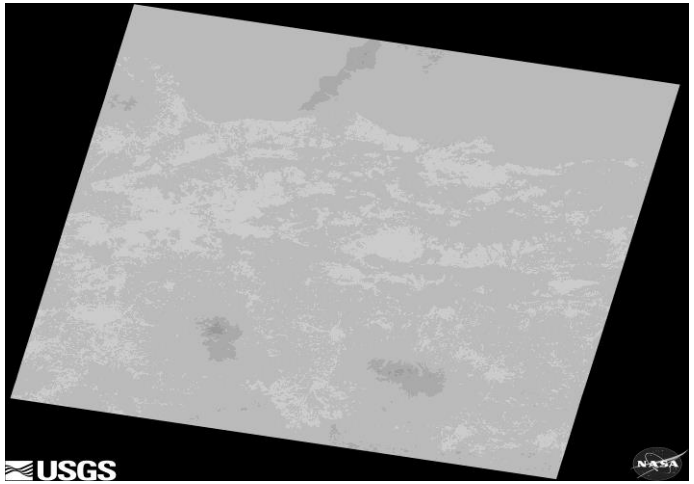
Darcy's law

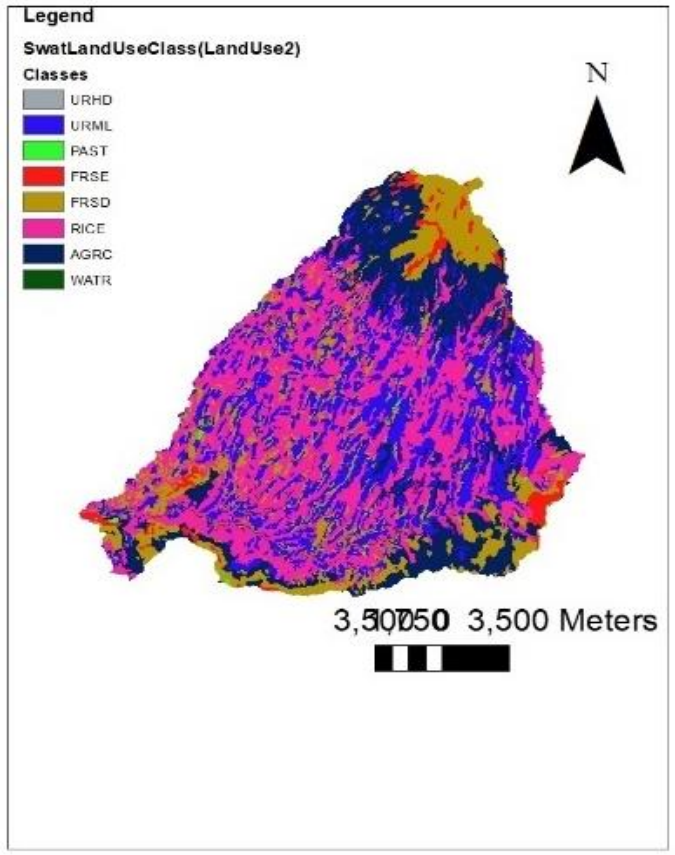
$$Q = AK\frac{dH}{dL}$$

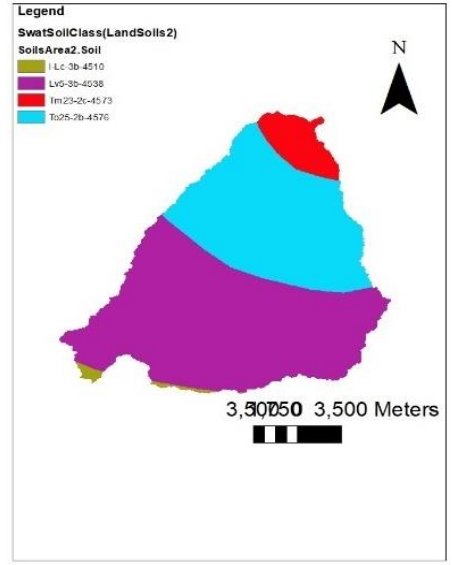
Slope parameter implied

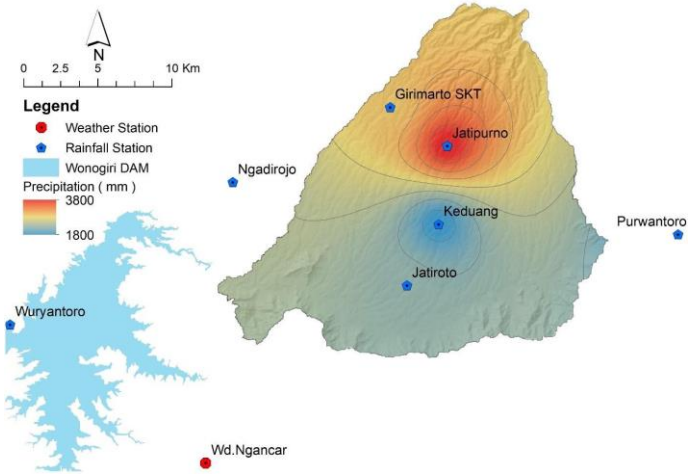
Soil Parameter

River









Finally, it was run and simulated (2008-2017) with two years warm-up (2008 -2009)

Model Calibration, Validation and Evaluation

Table 1. Discharges

No	Parameter name	Description of parameters
1	CN2.mgt	Moisture condition II curve number
2	Alpha.BF.gw	Baseflow alpha factor
3	GW_Delay.gw	Groundwater delay
4	SOL_K.sol	The saturated hydraulic conductivity
5	SOL_BD.sol	Moist bulk density
6	SOL_AWC.sol	Available water capacity
7	HRU_SLP.hru	Average slope steepness

Table 2. Sediment Yield parameters

No	Parameter name	Description of parameters
1	USLE_K	USLE soil erodibility factor [t.ha.h./(ha.MJ.mm]
2	USLE_P	USLE support practice factor

Parameterize terrace paddy field

Curve Number adjustment

- The range value of CN is between 62 – 81 with targeting slope steepness classes (Neitsch et al, 2011), (Khelifa et al, 2018).

The Slope Length (SL)

- The range value of SL is 20 – 70 with targeting slope steepness classes.

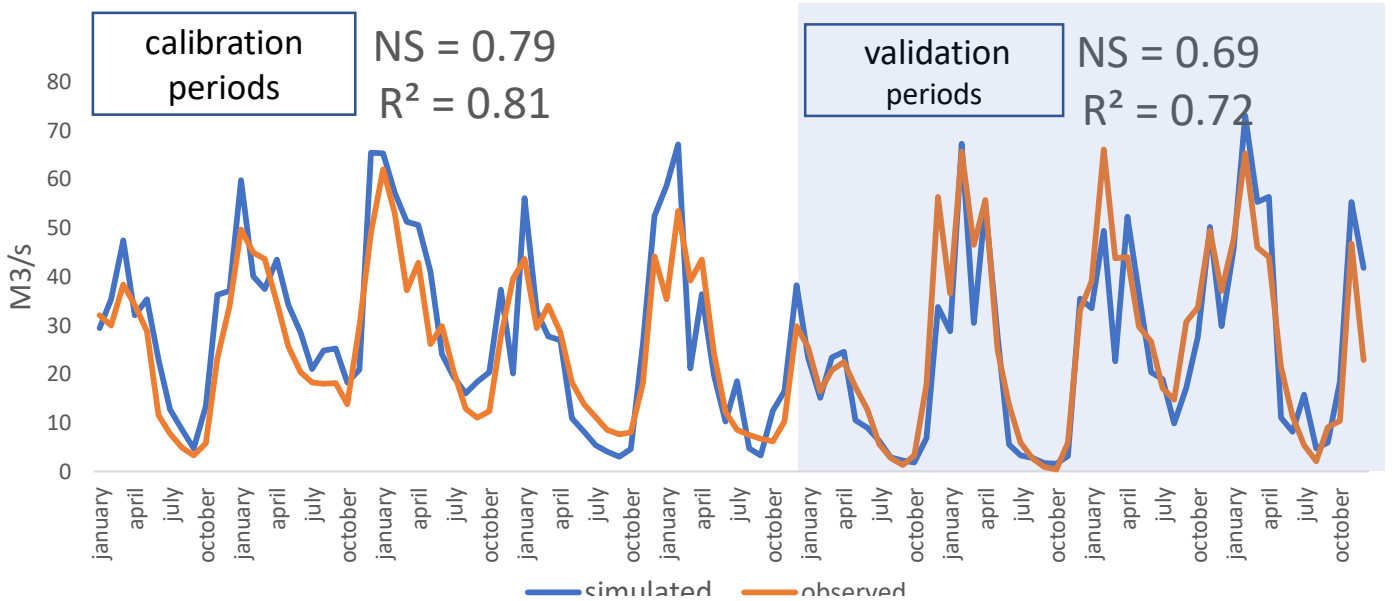
The Support practice factor

- The range value of P factor is between 0.5 – 0.9 with targeting slope stepness classes(Neitsch et al 2011).

Slope
0 - 8 %
8 - 15 %
15 – 25 %
25 – 45 %
>45 %

Results and Discussions

Calibration and Validation



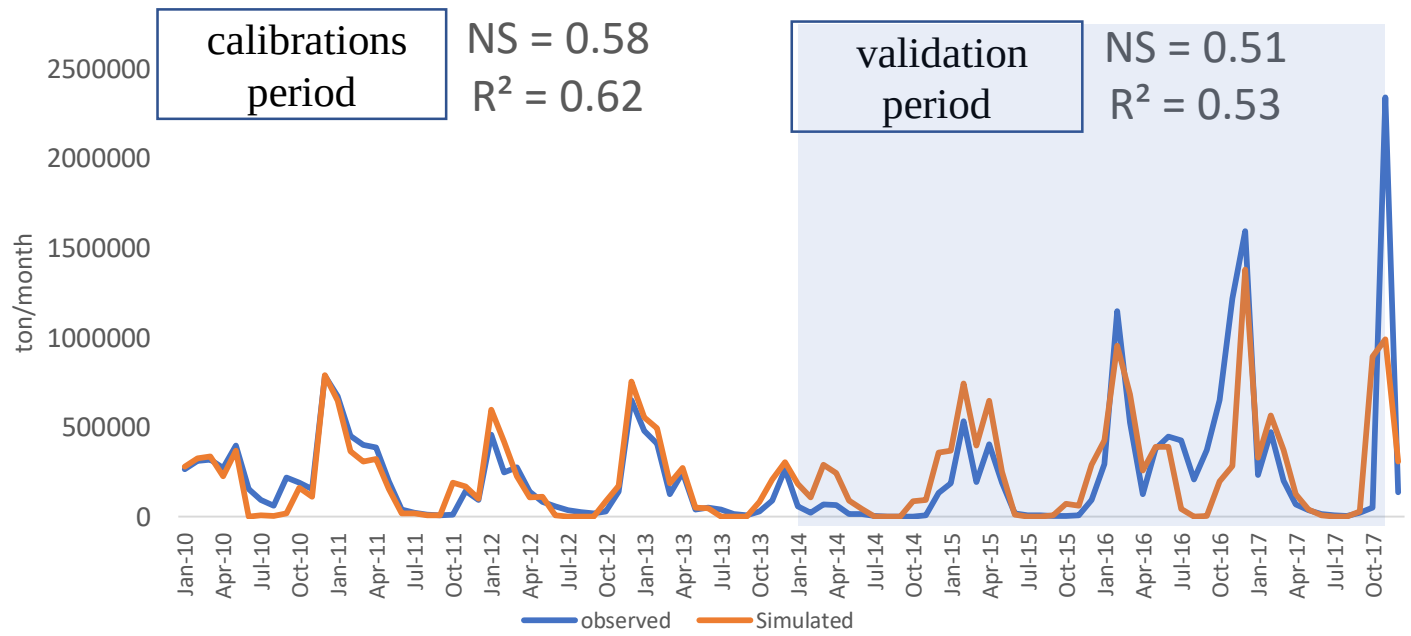
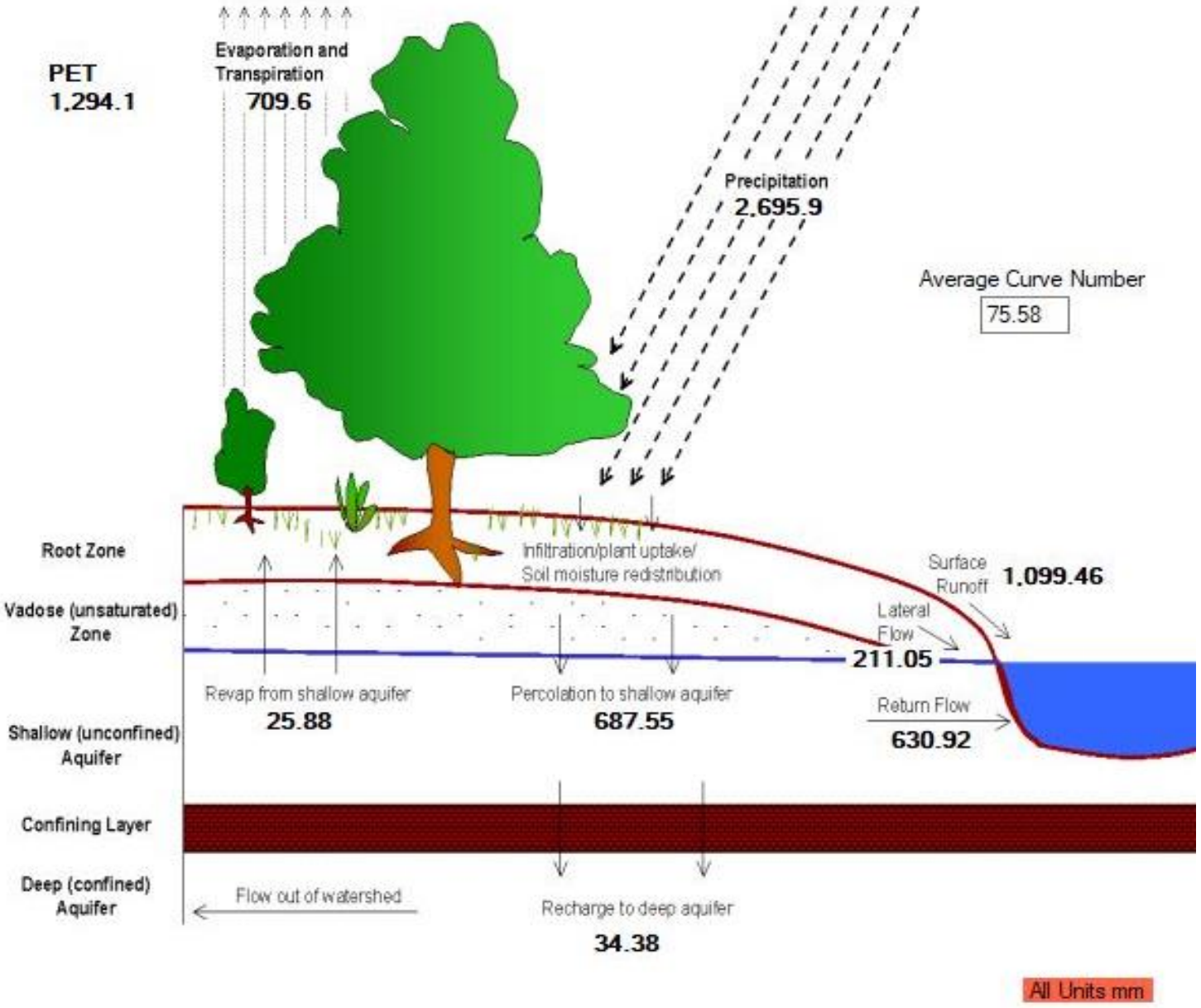


Table 3. CN,P factor, SL after calibration

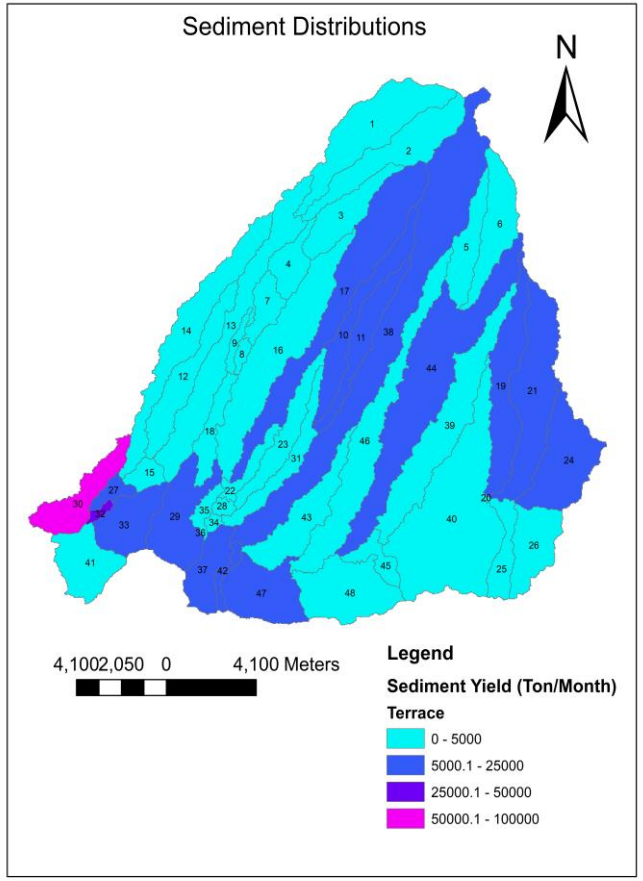
Slope	CN2	P factor	Slope length
0-8 %	62	0.52	70
8-15%	68	0.58	55
15-25 %	72	0.65	50
25-45%	76	0.75	30
>45 %	81	0.84	20

Water Balance Analysis

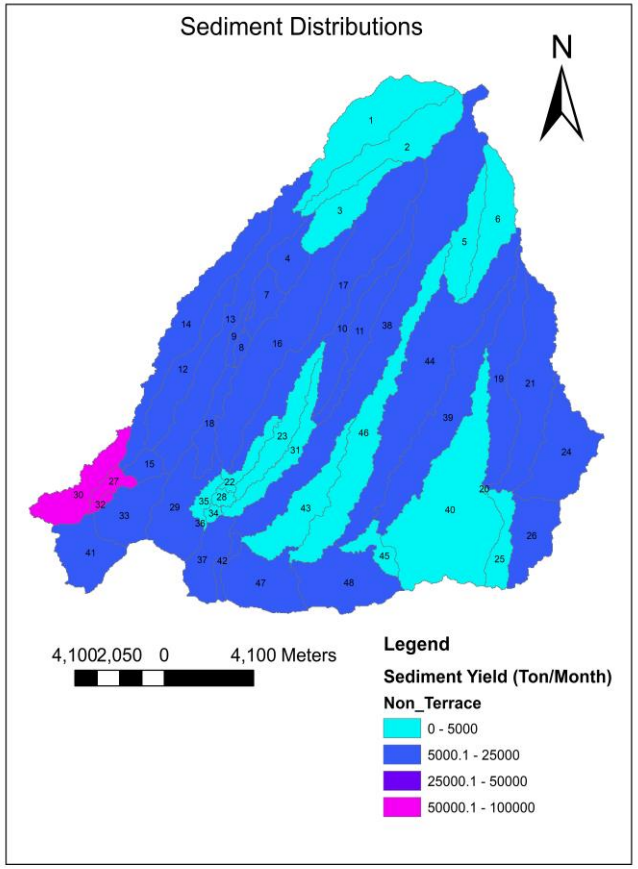


Variable	Value (mm)
Precipitation	2695.9
Potential Evapotranspiration	1294.1
Actual Evapotranspiration	709.6
Surface Runoff	1099.46
Lateral Flow	211.05
Return Flow	630.92
Percolation	687.55
Recharge Deep Aquifer	34.38
Revap from shallow aquifer	25.88

TERRACE



Non-TERRACE



The results indicated that terraced paddy feld could reduce sediment about 39.76 %

Conclusions

- The CN values ranging between 62 - 81, the value of P factor between 0.52-0.84 the value of SL ranging between 20-70 m
- Terrace paddy fields has a significant role for reducing sedimentation in Keduang sub-watershed about 39.76 %

THANK YOU FOR YOUR KINDLY ATTENTION

ありがとうございました