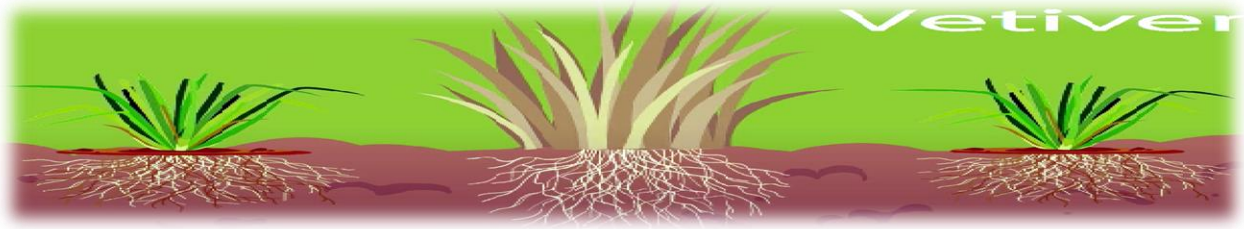
7th International Conference on Vetiver
Chiang Mai, Thailand 2023



"BOOG-FAG Web Application of Soil Erosion Risk Assessment in Thailand's Watershed for Contributing the Application of the Vetiver System"

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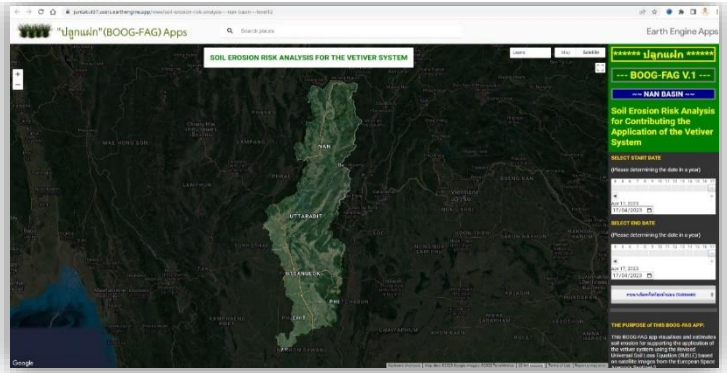
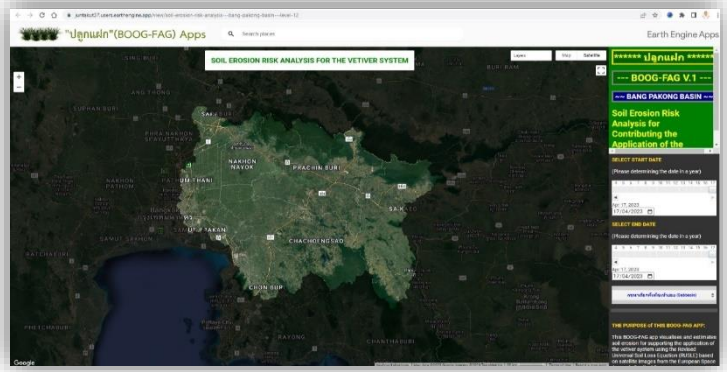
Briefing Outline

1) Introduction/Motivation
2) Objectives
3) Methodology
4) Results
5) Conclusion & Future Application

Google Earth Engine

"ปลูกแฝก"(BOOG-FAG) Apps





1. Introduction

How to contribute the application of the vetiver system and transfer knowledge for reinforcing the sustainability of water and soil conservation in class?

- Vetiver system can solve soil erosion and reduce runoff as internationally known through the characteristics of vetiver grass.
- Vetiver grass has a massive, finely structured root system with around 3 to 4 meters into the soil.

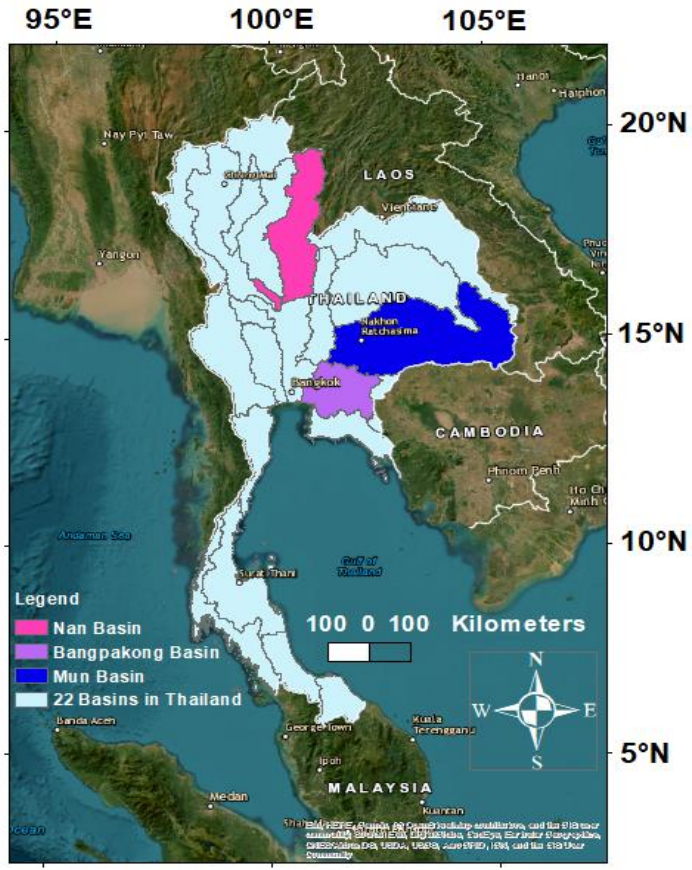
"ปลูกแฝก"(BOOG-FAG) Apps

2. Objectives

The aims of this study include:

(1) create BOOG-FAG apps for estimating soil erosion risk in Thailand's watershed with the Google Earth Engine (GEE) in *Nan, Bang Pakong, and Mun* watershed in Thailand as case studies.

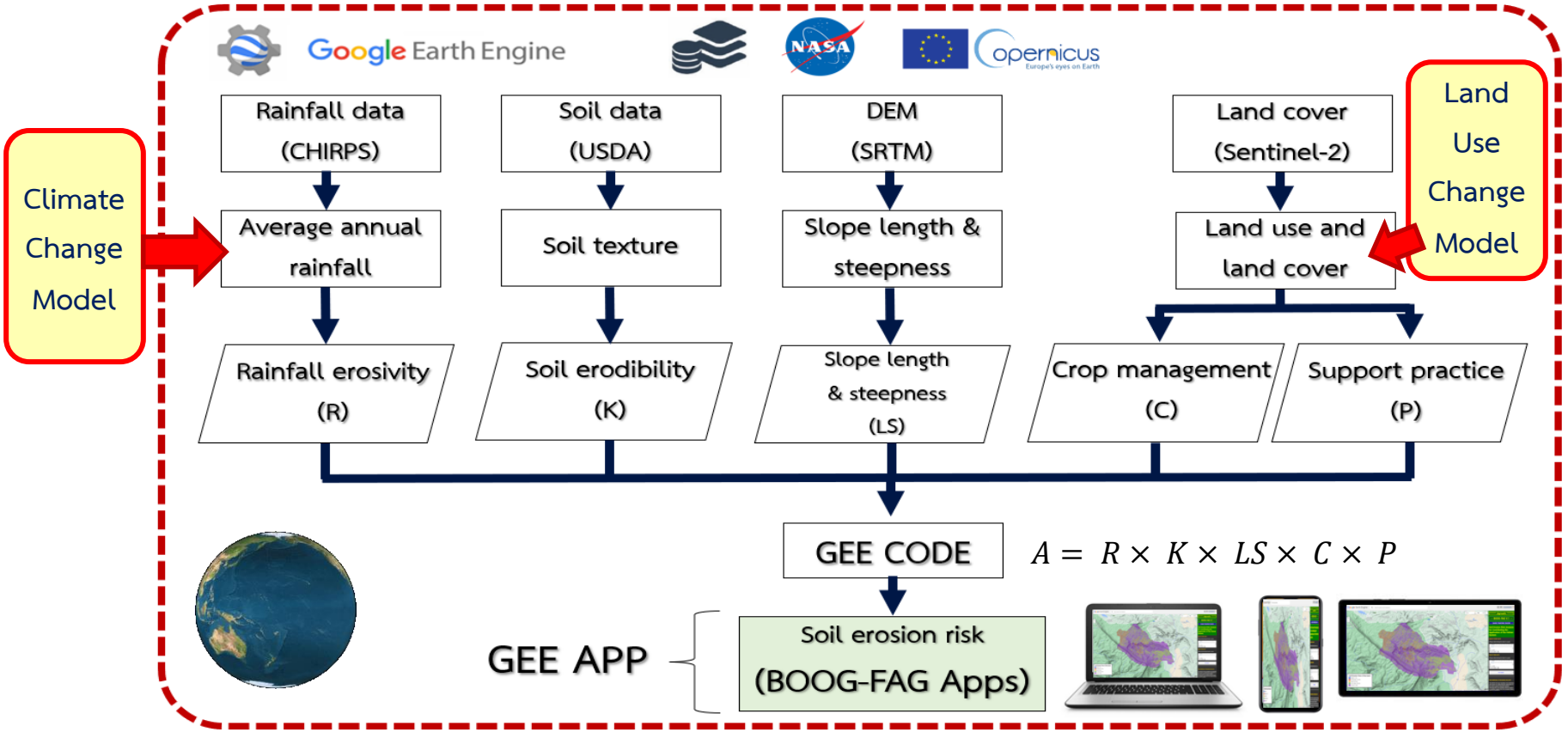
(2) transfer knowledge of the BOOG-FAG apps through a research project-based learning in higher education.



Google Earth Engine

"ปลูกแฝก"(BOOG-FAG) Apps

3. Methodology



$$R = 0.4669X - 12.1415$$

Table 2. K values in each soil texture class (LDD, 2020).

No.	Soil texture	Abbreviation	K values		
			Nan basin	Bang Pa Kong basin	Mun basin
1	Sand	Sa	0.05	0.04	0.04
2	Loamy sand	LoSa	0.05	0.08	0.04
3	Sandy loam	SaLo	0.27	0.30	0.29
4	Loam	Lo	0.33	0.33	0.29
5	Silt loam	SiLo	0.49	0.56	0.37
6	Silt	Si	0.57	0.57	0.57
7	Sandy clay loam	SaClLo	0.21	0.20	0.24
8	Clay loam	ClLo	0.24	0.28	0.25
9	Silty clay loam	SiClLo	0.35	0.38	0.46
10	Sand clay	SaCl	0.17	0.15	0.15
11	Silty clay	SiCl	0.21	0.26	0.23
12	Clay	Cl	0.15	0.14	0.13

$$LS = \left(\frac{l}{72.6}\right)^{m} \left(65.41sin^2\theta + 4.56sin\theta + 0.065\right)$$

$$C = exp\left[-\alpha \cdot \frac{NDVI}{(\beta - NDVI)}\right]$$

Table 3. P values in each land use and land cover class (LDD, 2020).

No.	LULC class	P value
1	Dry evergreen forest	0.1
2	Deciduous dipterocarp forest	1.0
3	Mixed deciduous forest	1.0
4	Forest plantation	1.0
5	Grass land	1.0
6	Paddy field	0.1
7	Field crop	1.0
8	Urban area	0
9	Water body	0

$$A = R \times K \times LS \times C \times P$$

A is the average annual soil erosion per unit area (tons ha^{-1} year^{-1});

R is the rainfall erosivity factor (MJ mm ha^{-1} hr^{-1} year^{-1});

K is the soil erodibility factor (tons hr ha^{-1} MJ^{-1} mm^{-1});

LS is the slope length-steepness factor (dimensionless);

C is the cover and management factor (dimensionless); and

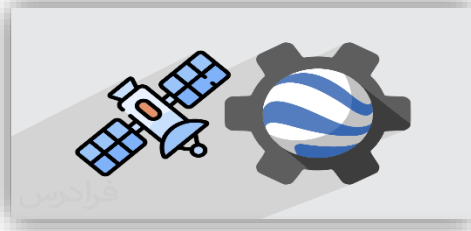
P is the erosion support practice or land management factor (dimensionless).

The Land Development Department of Thailand (LDD, 2020)

3. Methodology

Table 5. Overview of the datasets used in this study.

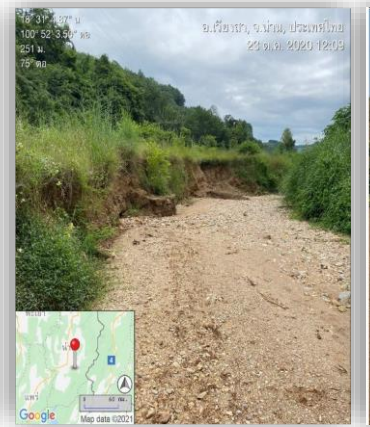
Factor	Data	Dataset provider	Scale	Unit	Remarks
Rainfall erosivity (R)	Rainfall	U.S. Geological Survey (USGS) of Earth Resources Observation and Science (EROS) Center	global, 0.05°	MJ mm ha^{-1} hr^{-1} $year^{-1}$	https://developers.google.com/earth-engine/datasets/catalog/UCSB-CHG_CHIRPS_PENTAD
Soil erodibility (K)	Soil texture	U.S. Department of Agriculture (USDA)	global, 250 m	tons hr ha^{-1} MJ^{-1} mm^{-1}	https://developers.google.com/earth-engine/datasets/catalog/OpenLandMap_SOL_SOL_TEXTURE-CLASS_USDA-TT_M_v02
Slope length and steepness (LS)	Digital Elevation Model	U.S. Geological Survey (USGS)	global, 30 m	dimensionless	https://developers.google.com/earth-engine/datasets/catalog/USGS_SRTMGL1_003#description
Crop management (C)	Normalize Difference Vegetation Index	European Space Agency	global, 10 m	dimensionless	https://developers.google.com/earth-engine/datasets/catalog/COPERNICUS_S2
Support practices (P)	Land cover	U.S. Geological Survey (USGS)	global, 30 m	dimensionless	https://developers.google.com/earth-engine/datasets/catalog/MODIS_061_MCD12Q1

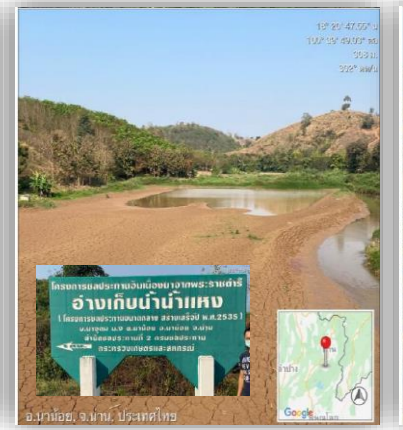


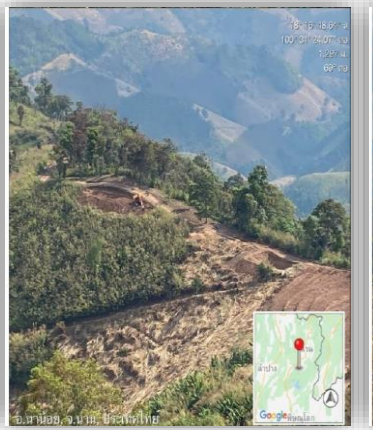
3. Methodology

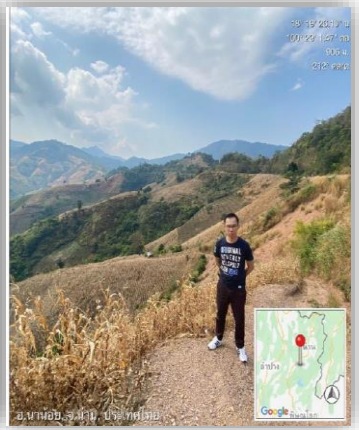
Table 4. Class of soil erosion risk assessment (LDD, 2020).

Class	Soil erosion risk assessment	Rate of soil erosion	
		ton/rai/yr	ton/ha/yr
1	Very mild	0.00 – 2.00	0.00 – 12.5
2	Mild	2.01 – 5.00	12.50 – 31.25
3	Moderate	5.01 – 15.00	31.25 – 93.75
4	Severe	15.01 – 20.00	93.75 -125
5	Very severe	>20.01	>125



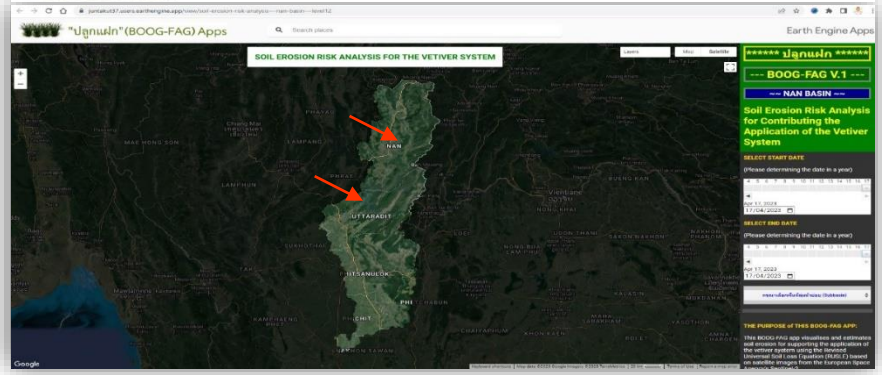


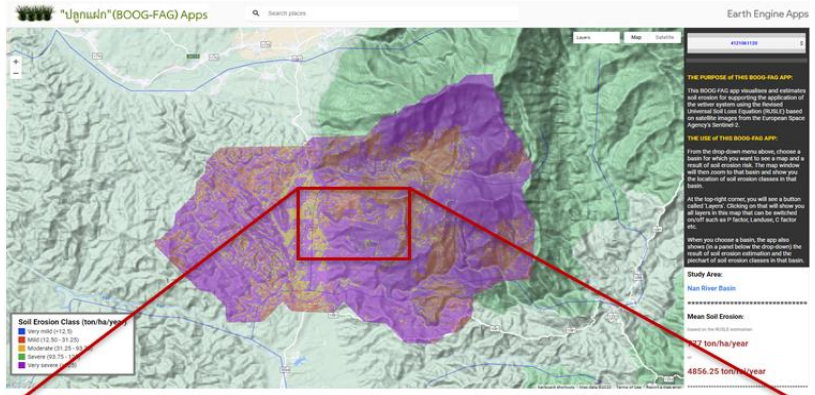


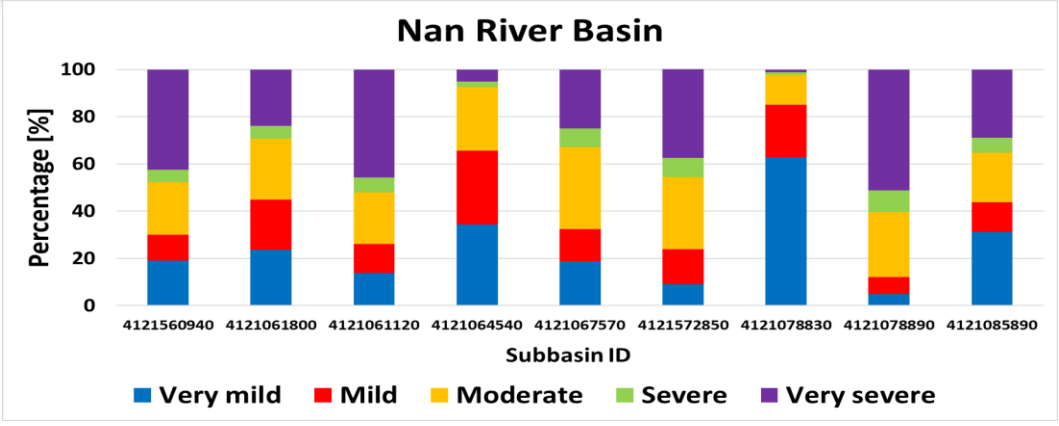


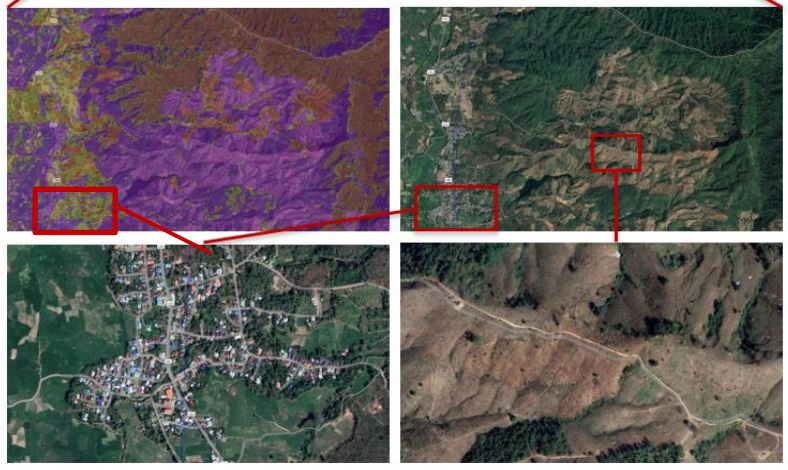
4. Results

"ปลูกแฝก"(BOOG-FAG) Apps









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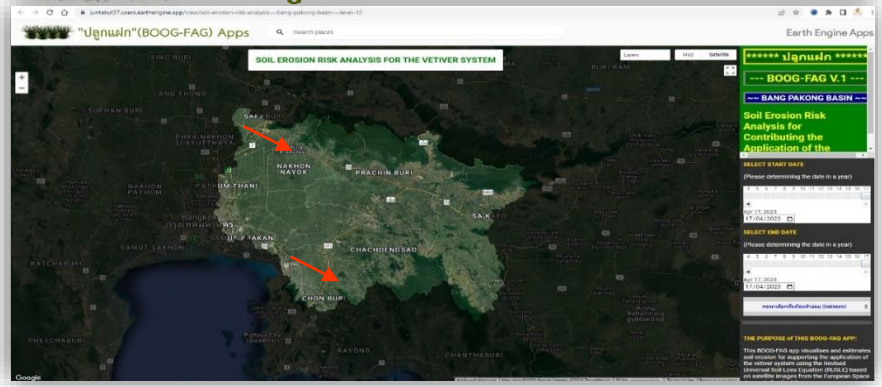

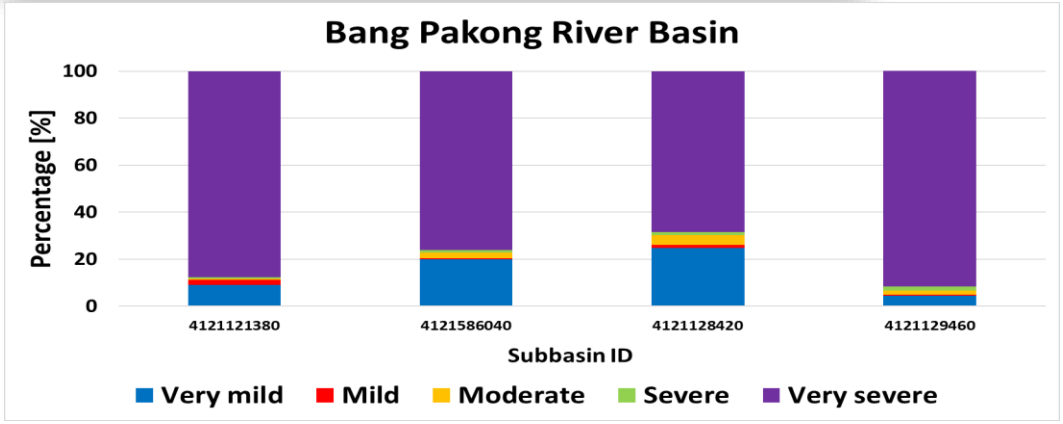

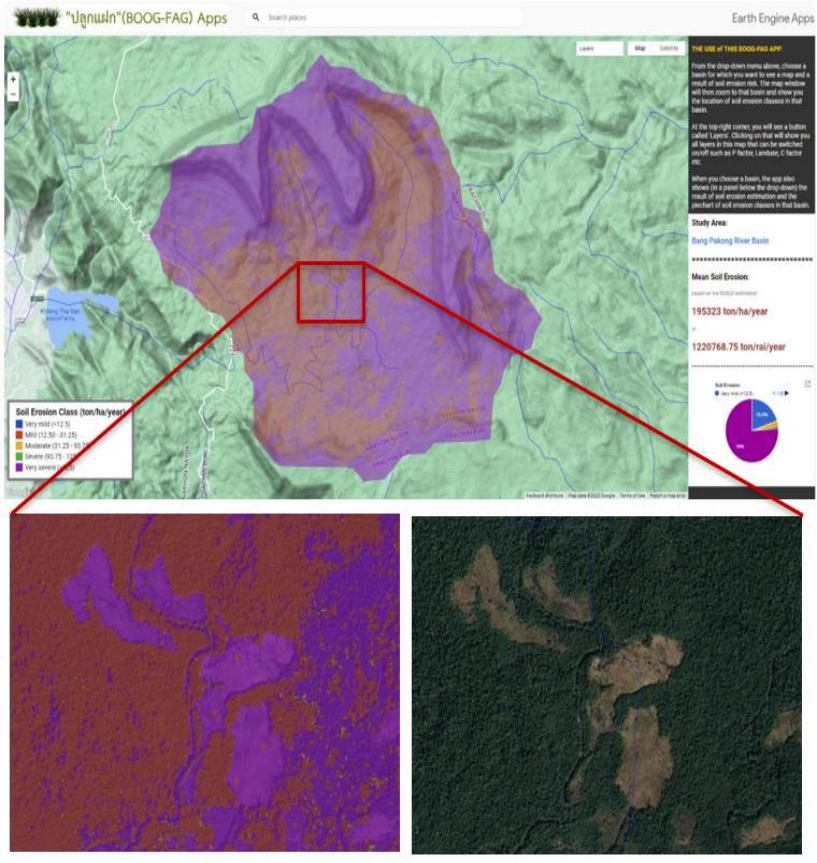

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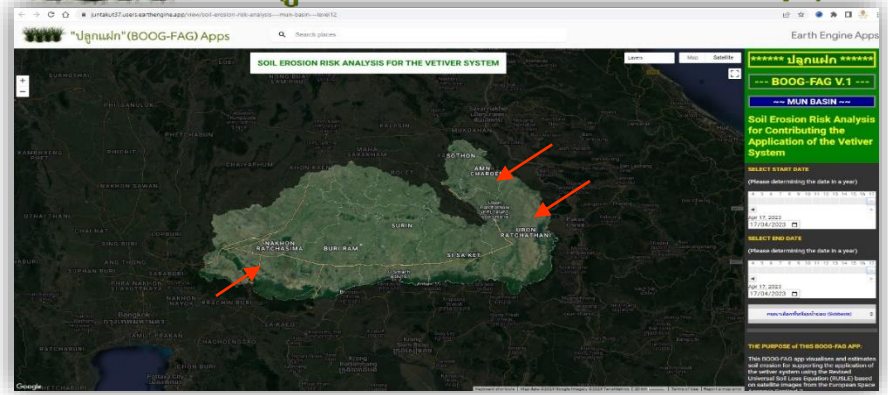

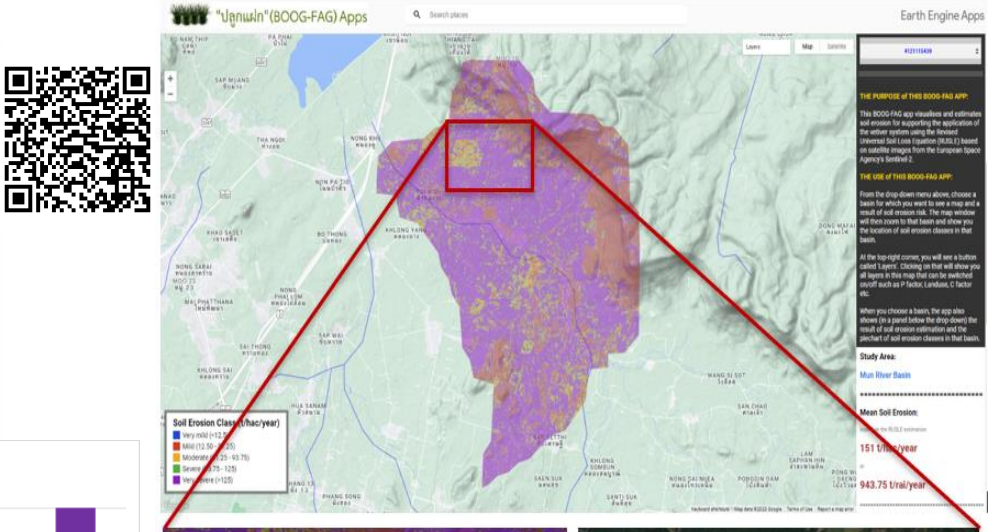

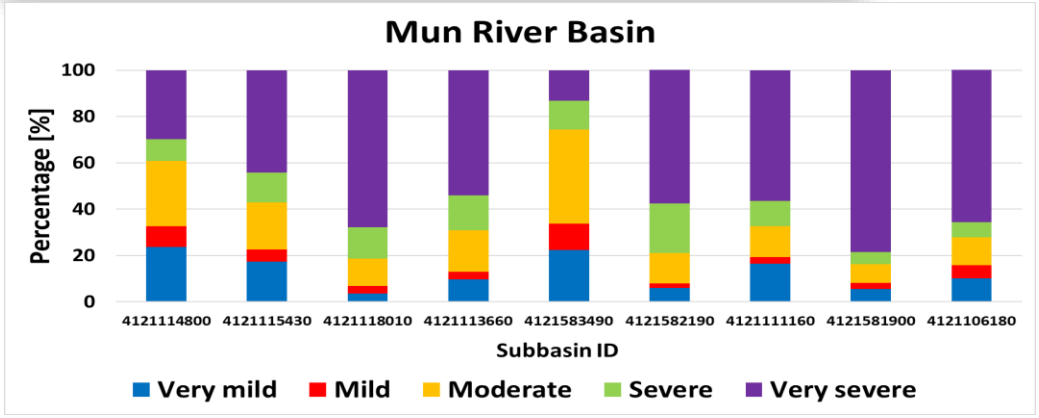

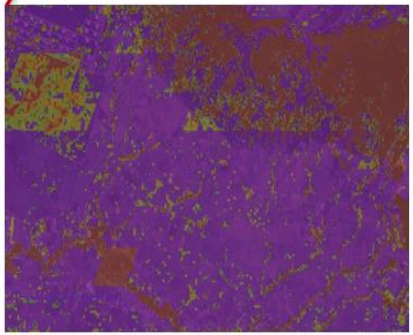

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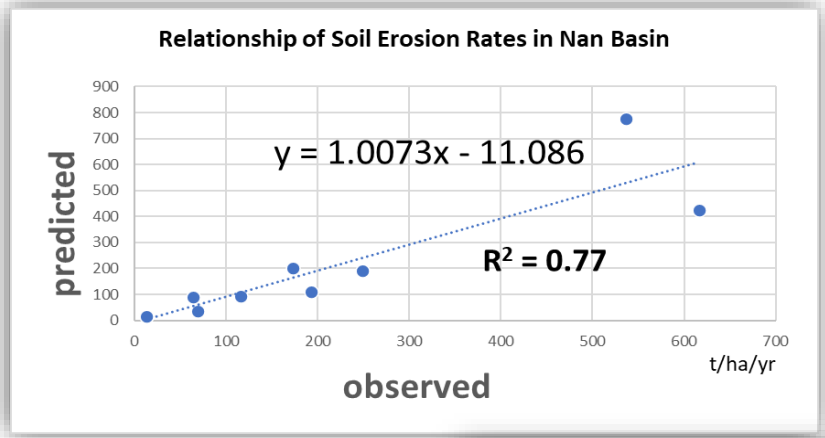
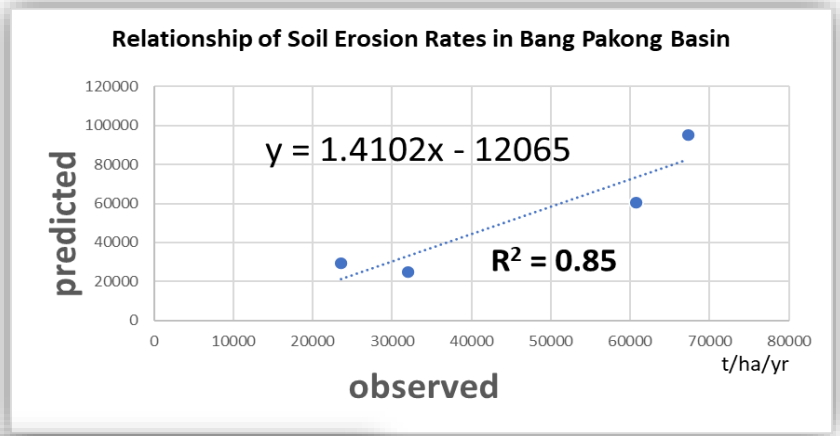
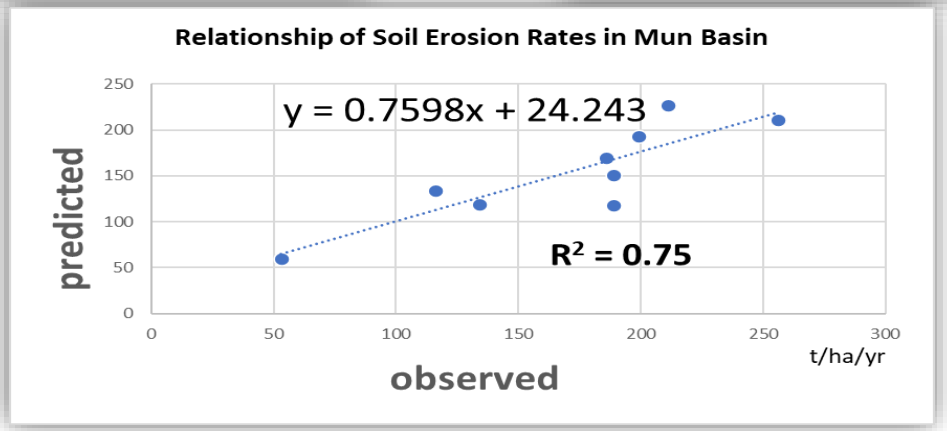




$$R^2 = 1 - \frac{\sum(y_i - \hat{y}_i)^2}{\sum(y_i - \bar{y})^2}$$



The Land Development Department of Thailand (LDD, 2020)

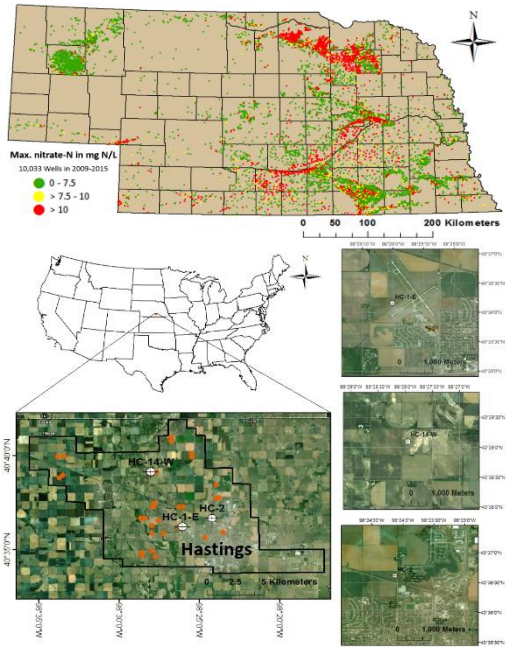
Royal Irrigation Department (RID, 2019)

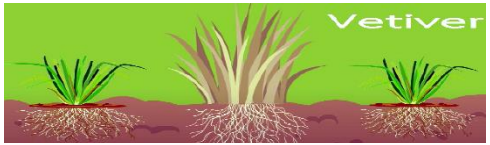
5. Conclusion

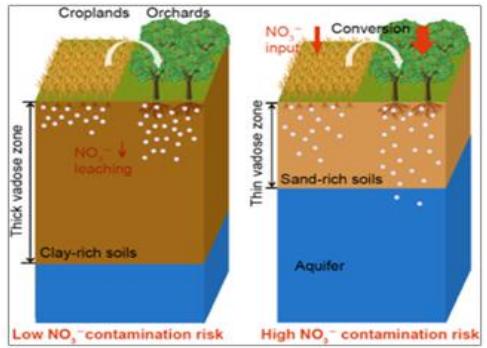
- The study found that there is a relationship between the RUSLE and the field data with the R square of 0.77 (77%), 0.85 (85%), and 0.75 (75%) in Nan, Bang Pakong, and Mun watersheds, respectively.
- The BOOG-FAG apps can be an efficient tool for the contribution of the application of the vetiver system and supporting a decision of stakeholder.
- The knowledge of this apps and soil erosion risk assessment are educated for students in class to encourage understanding and awareness of water and soil conservation.
- This study can be a tool of soil erosion protection to support for achieving the Sustainable Development Goals (SDGs).

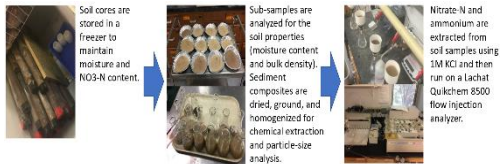
5. Future Works

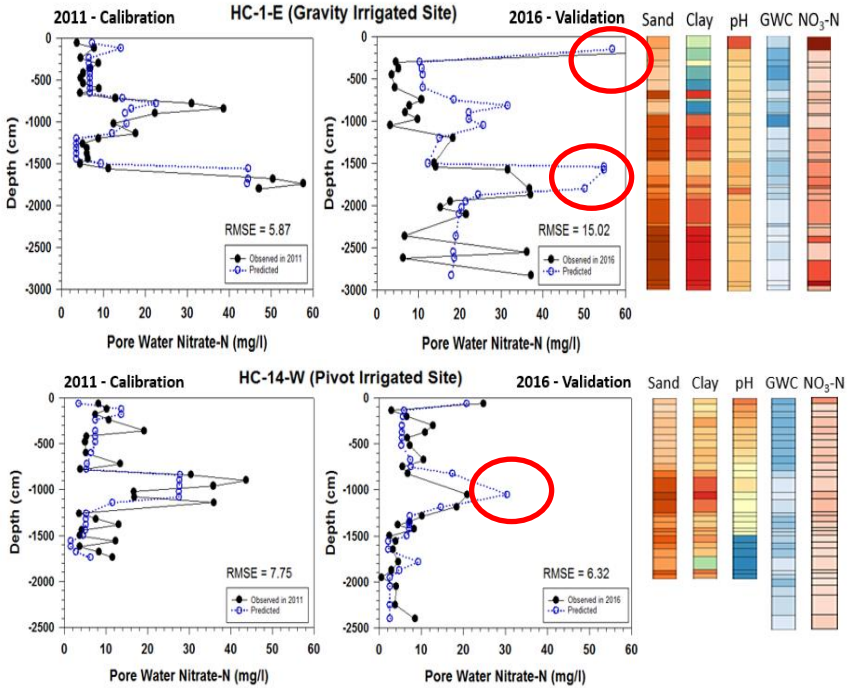
- Vetiver system for mitigating contaminated deep groundwater
- Climate change impacts to soil health and food production











Thank you very much for your attention!

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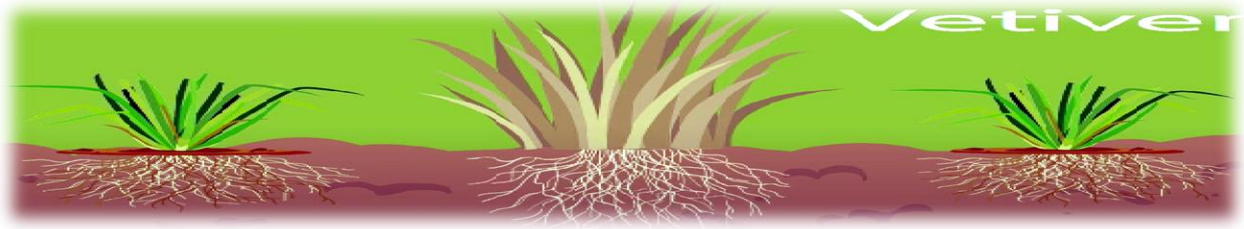

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