Impact of oil palm expansion on water quantity and Nitrate load in Merangin Tembesi Watershed, Jambi Province, Indonesia

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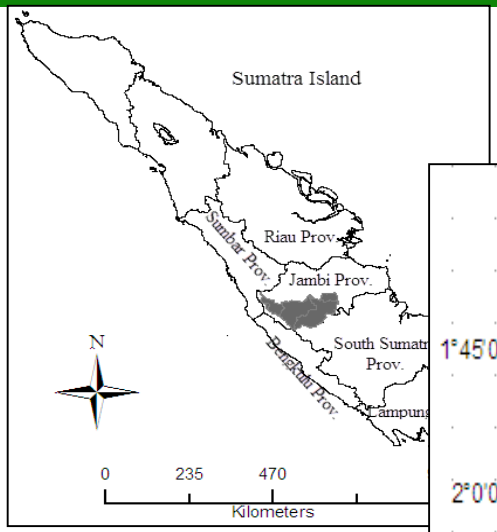
Introduction

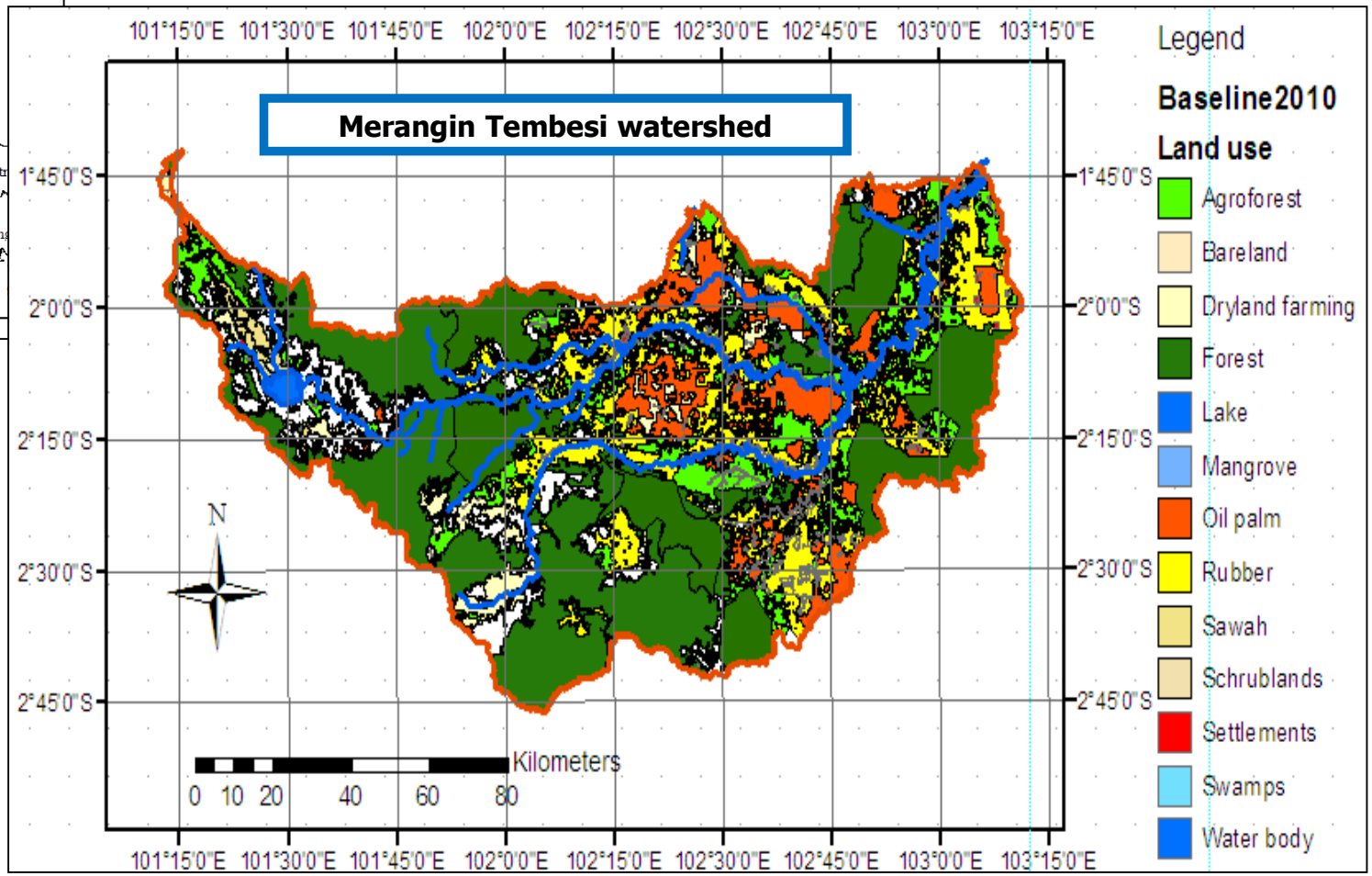
- Oil palm distribution in Indonesia
  - Year 2014 : 10 millions ha,
  - Year 2025 : 20 millions ha
- Widespread perception:
  - Oil palm affects significantly water quantity and quality
- Scientific researches on these issues are still scarce

Distribution of oil palm in Indoensia

Research Location



Hotspots of Indonesia's re-cent oil palm boom



Introduction

Ecological Functions **Economic Functions**

Research objective:
Predicting impact of oil palm expansion on water quantity and quality using SWAT

Methodology – SWAT parameterization

Field measurement of specific hydrological characteristics in oil palm

Bulk density

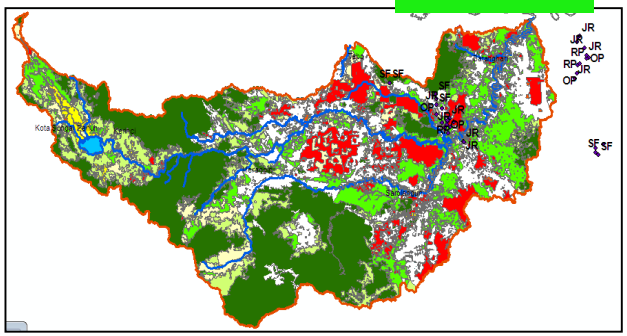
Infiltration

Canopy Interception

Nitrate in surface runoff

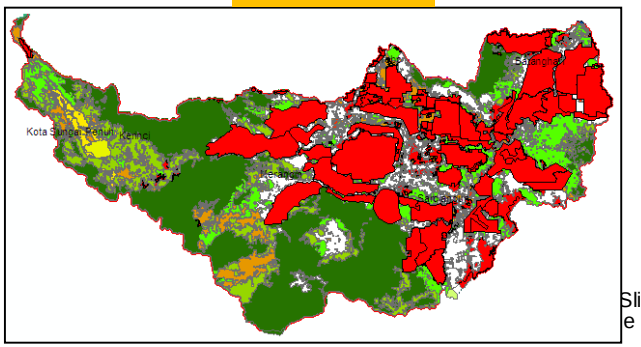
Parameterization of SWAT Model

Baseline



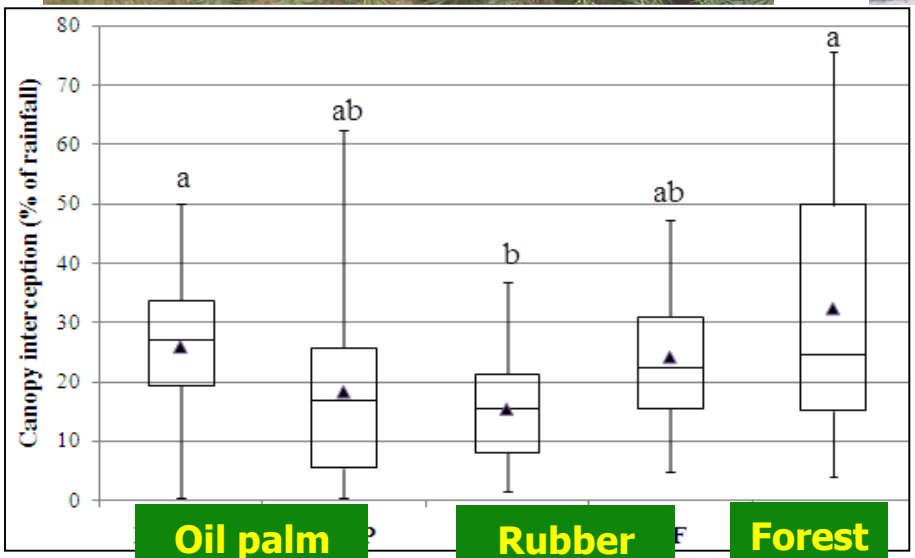
Impact of oil palm expansion on Water yield, water quality

Scenario



Result and Discussion

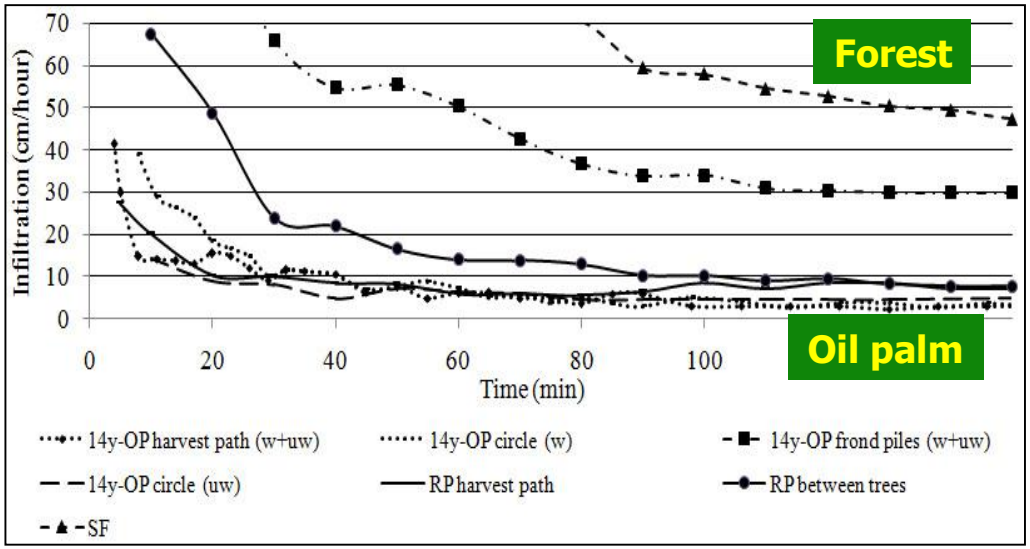
Oil palm Canopy Interception



→ **CANMX.hru**

Result and Discussion

Oil palm soil infiltration



HSG → CN2

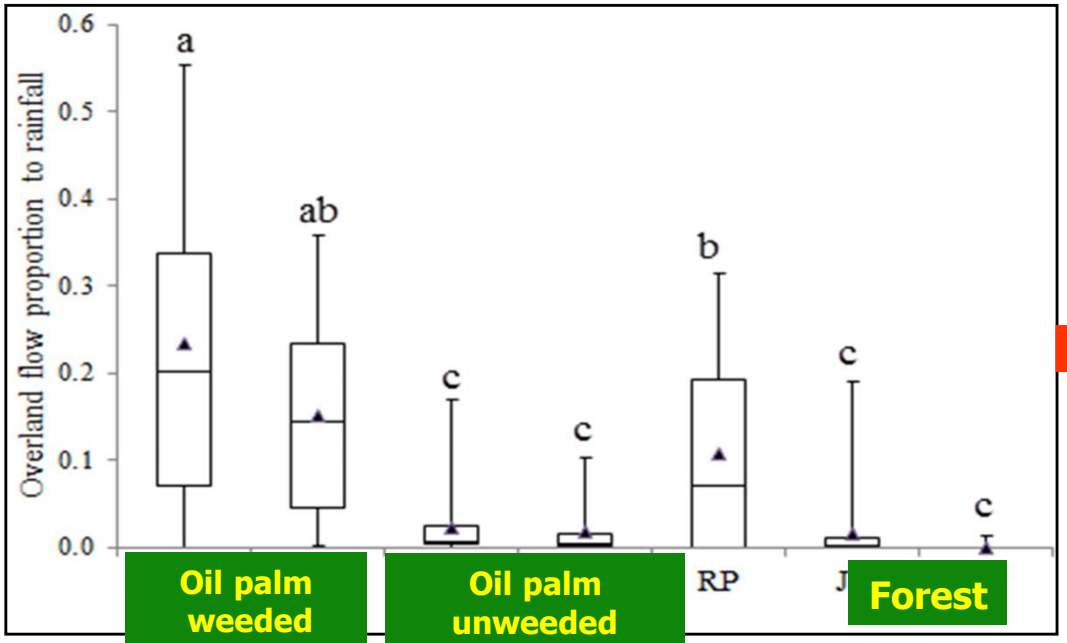
Result and Discussion

Overland flow

Oil Palm

Rubber

Forest



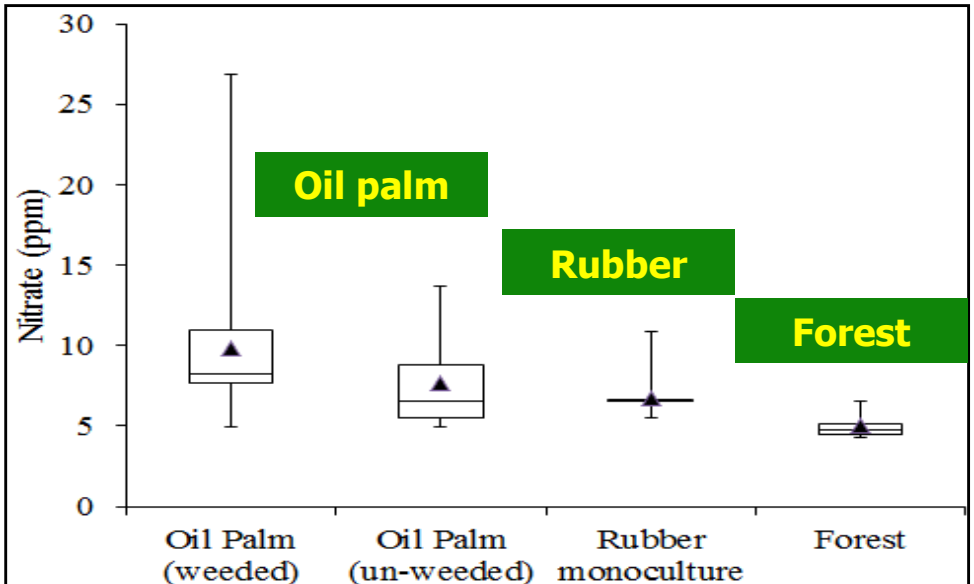
HSG → CN2

OV_n

Result and Discussion

Nitrate load

Fertilizer:
6.75 kg NPK/tree/year
(oil palm: 143 trees/ha)



Management operations

Field Measurement as initial SWAT Parameters

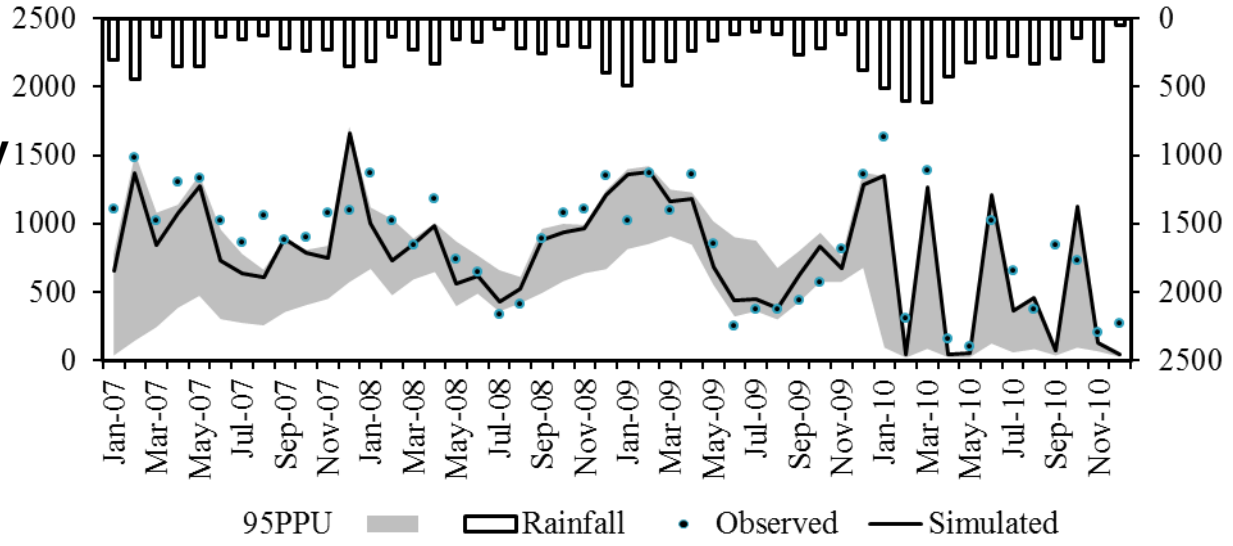
Table 2 The SWAT input parameters in different land use types obtained from the plot experiment.

SWAT input parameters	Units	Oil palm	Rubber	Agroforest	Secondary Forest
Maximum canopy storage (CANMX)	mm	4.0	2.7	4.3	5.8
Hydrologic soil groups (HSG)		D	D	C	B
Curve Number (CN2)*		88	85	76	55
Bulk density (SOL_BD)	gcm^{-3}	1.24	1.30	1.22	1.14

* CN2 value for each land use type was adapted from SCS Engineering Division (1986) and Natural Resources Conservation Service (2007)

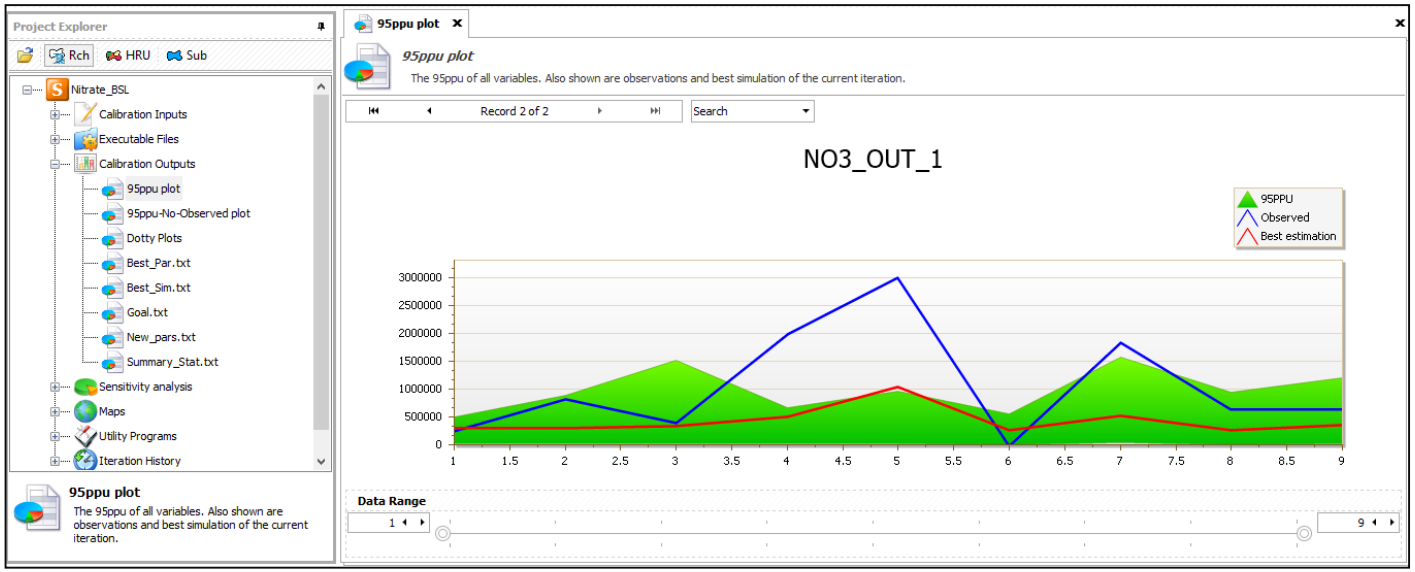
Model Calibration and Validation

Water Quantity



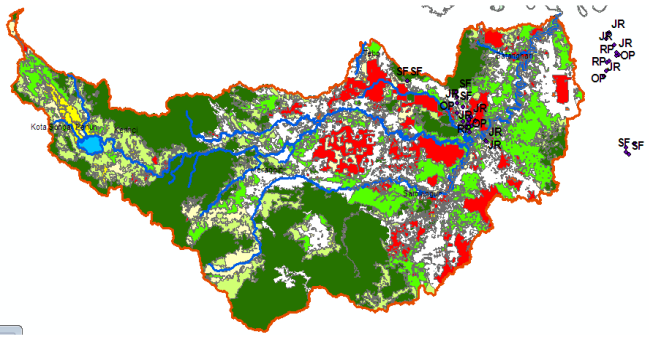
NS=0.6

Nitrate load



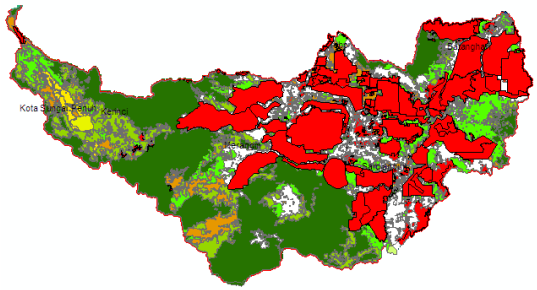
Result and Discussion

Baseline (Disbun -2010)



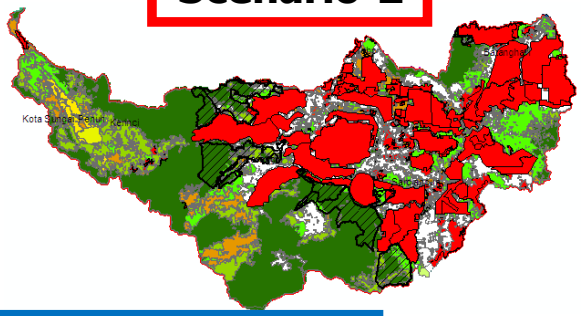
Existing Issued Permits Mapping

Scenario 1

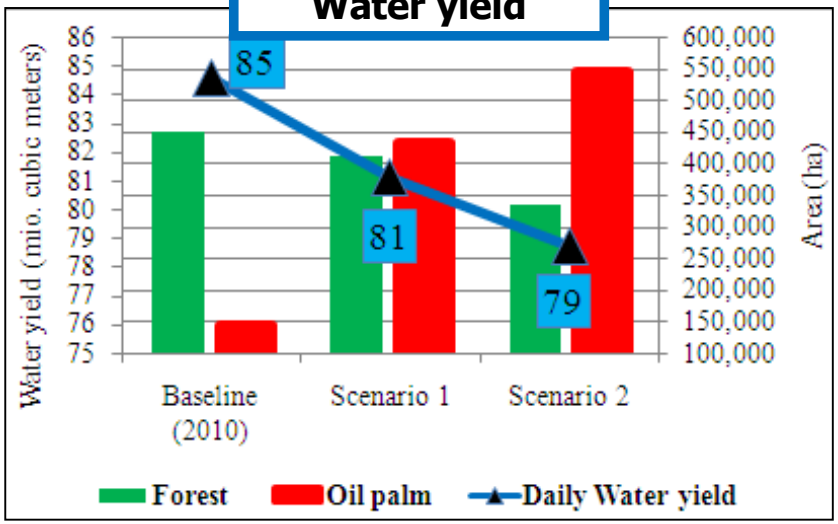


Future conversion of left over forest production

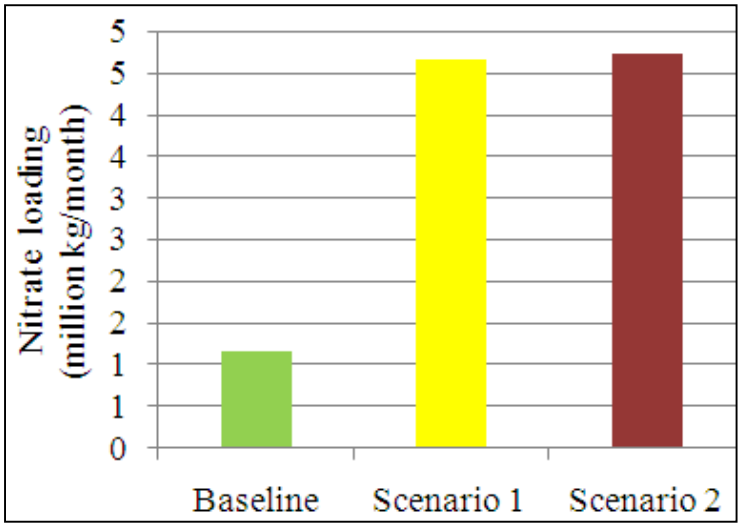
Scenario 2



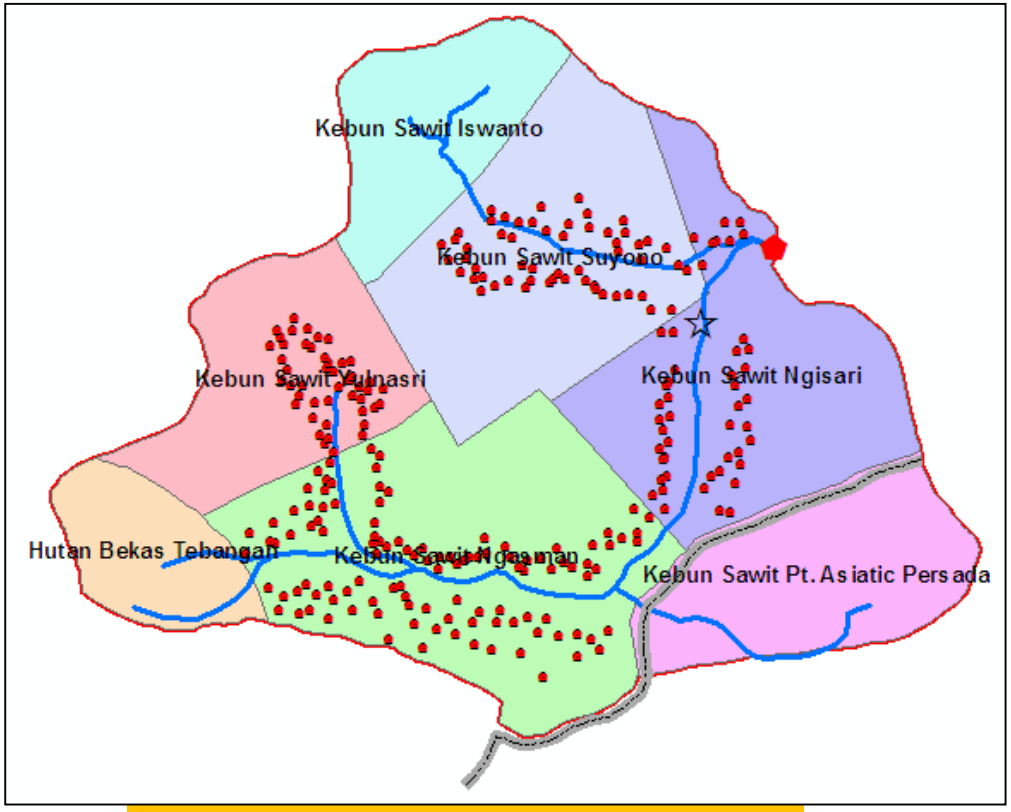
Water yield

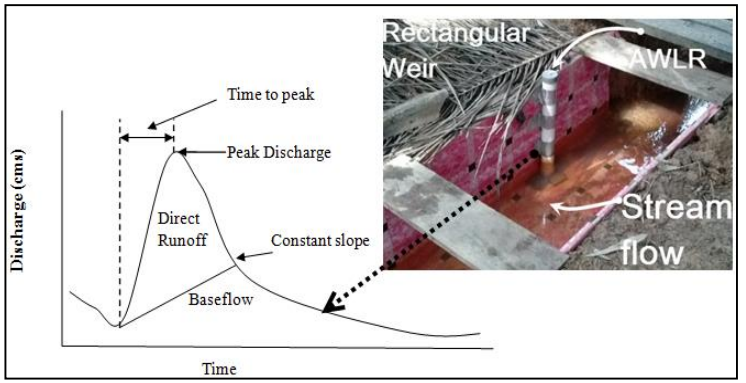


Nitrate load



On-going: Testing effectiveness of soil conservation measures in Oil Palm (silt-pit) plantation using SWAT





Silt Pit (20x15 ha=300 silt pit)

Conclusion

- Oil palm expansion affect significantly water quantity and water quality in watershed scale
- SWAT model can be used to test effectiveness of mitigation option
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