



^b
UNIVERSITÄT
BERN
CDE
CENTRE FOR DEVELOPMENT
AND ENVIRONMENT

IMPACT OF SOIL MAPS ON SWAT MODELLING

THE CASE STUDY OF THE PETITE GLÂNE WATERSHED (CH)

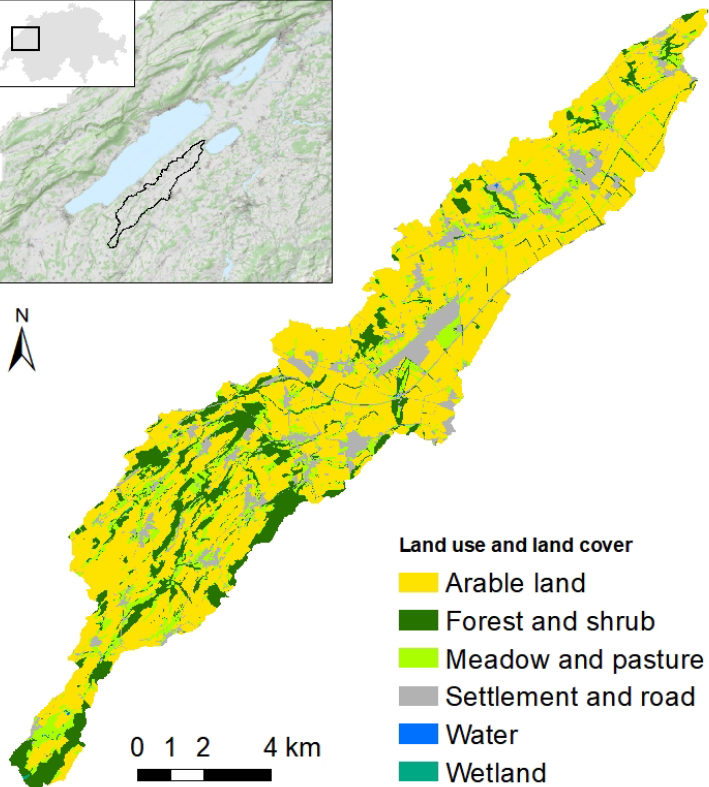
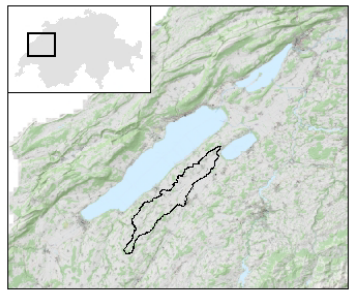
Joana Eichenberger (CDE)
Supervisors: Dr. Tatenda Lemann (CDE)
and Prof. Dr. Bettina Schäfli (GIUB)



OPTAIN

HORIZON 2020 RESEARCH & INNOVATION PROJECT

OPTimal strategies to **retAIN** and re-use water and nutrients in small agricultural catchments across different soil-climatic regions in Europe



Land use and land cover

- Arable land
- Forest and shrub
- Meadow and pasture
- Settlement and road
- Water
- Wetland

30/06/2023

u^b

^b
UNIVERSITÄT
BERN

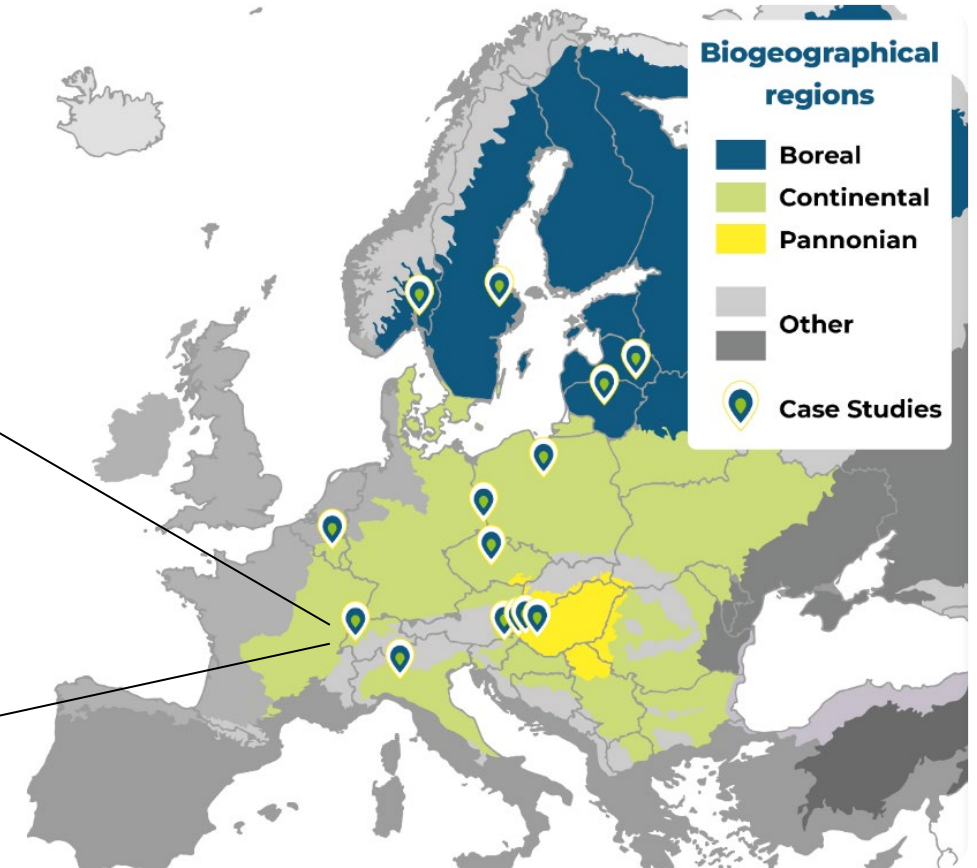
CDE
CENTRE FOR DEVELOPMENT
AND ENVIRONMENT



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
Agroscope



Biogeographical
regions

- Boreal
- Continental
- Pannonian
- Other
- Case Studies

OPTAIN

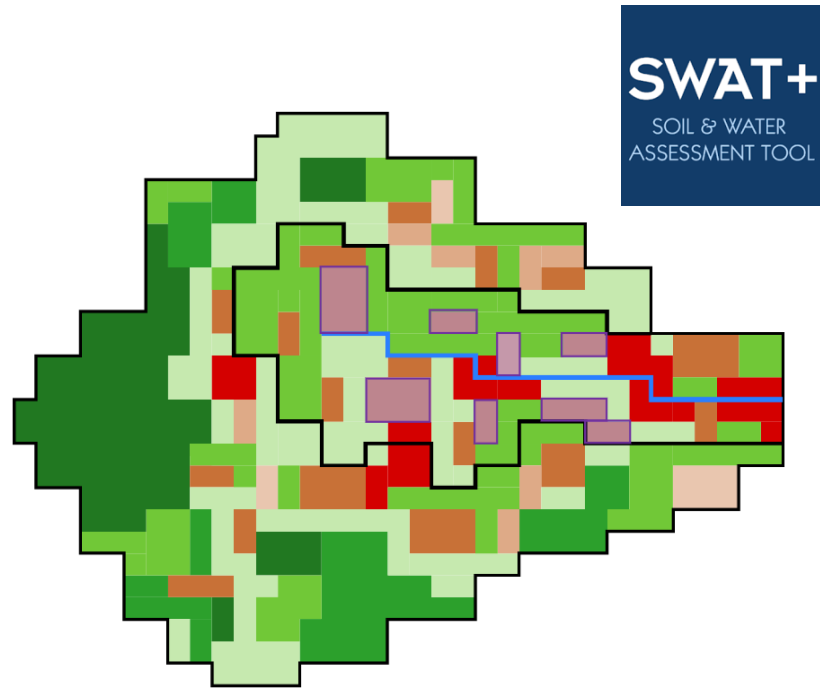
- Assess **local** impacts of Natural/Small Water Retention Measures (NSWRMs) and combination of NSWRMs at watershed level
- Model setup with QSWAT+: landscape is highly aggregated at the relevant level



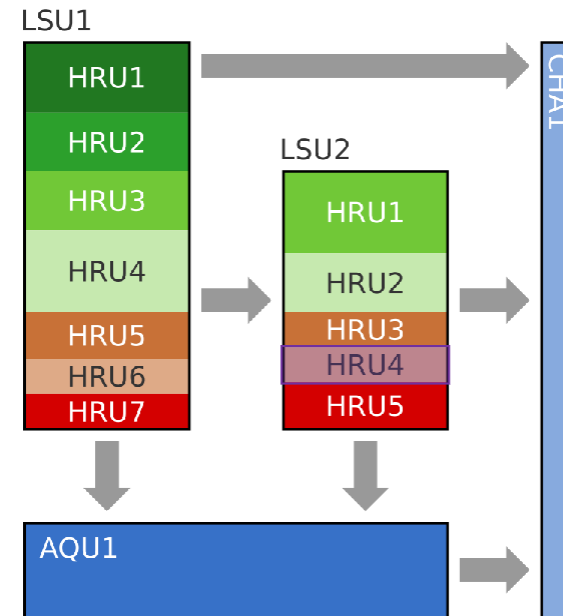


OPTAIN

SOIL AND WATER ASSESSMENT TOOL



HRUs: fragmented units with no spatial reference

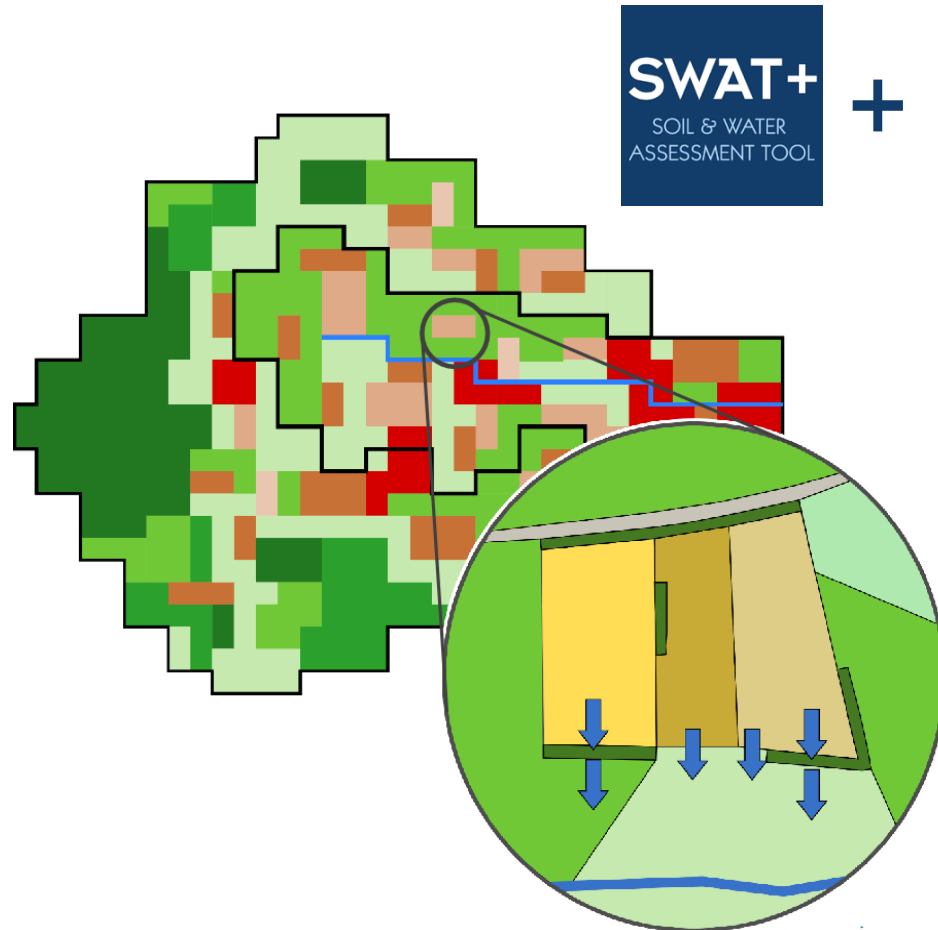


(Figures: Christoph Schürz)



OPTAIN

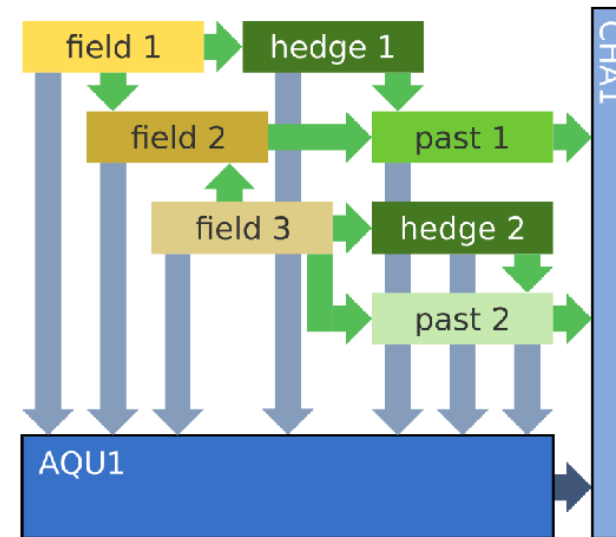
SOIL AND WATER ASSESSMENT TOOL



SWAT+
SOIL & WATER
ASSESSMENT TOOL

+ CONTIGUOUS OBJECT CONNECTIVITY APPROACH (COCOA)

Contiguous object: Self-contained spatial unit, defined border with neighbour objects

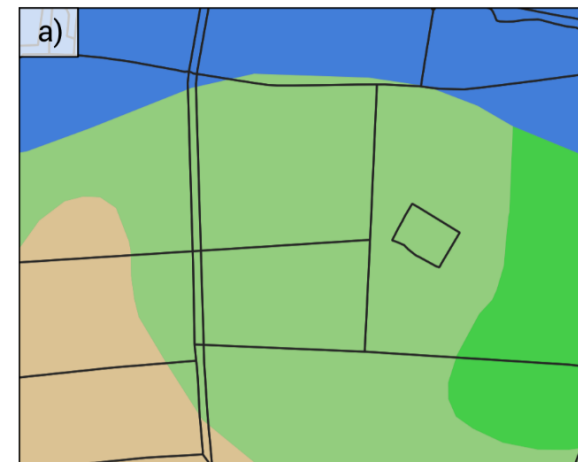
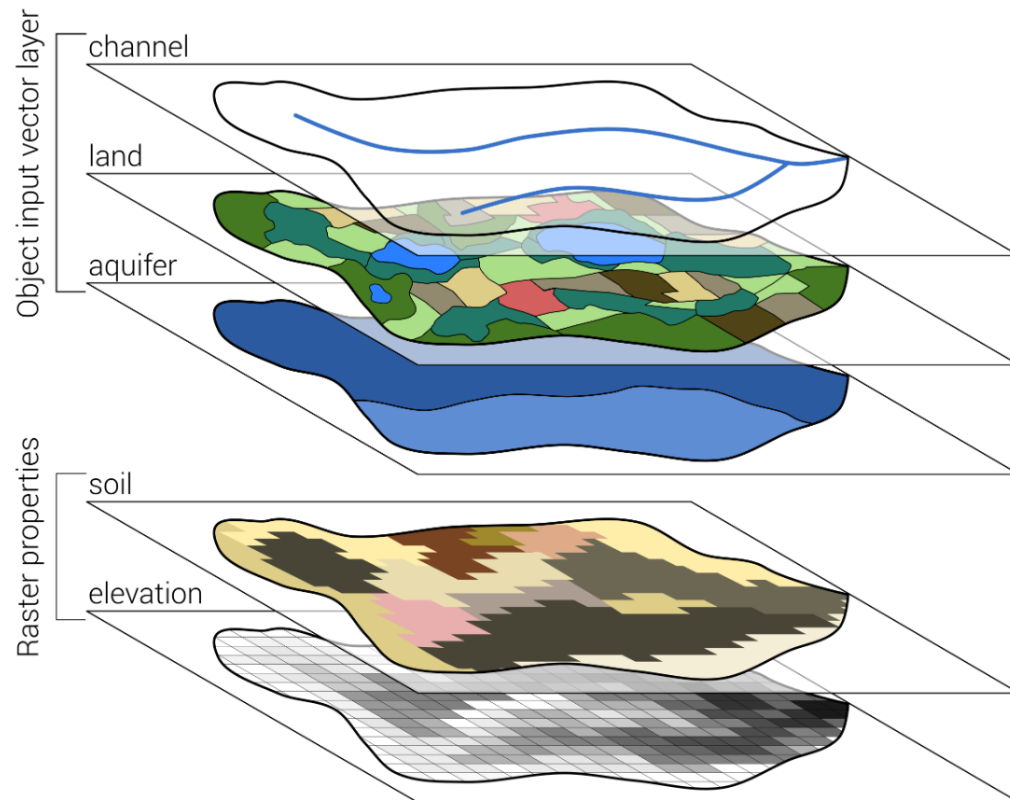


(Figures: Christoph Schürz)

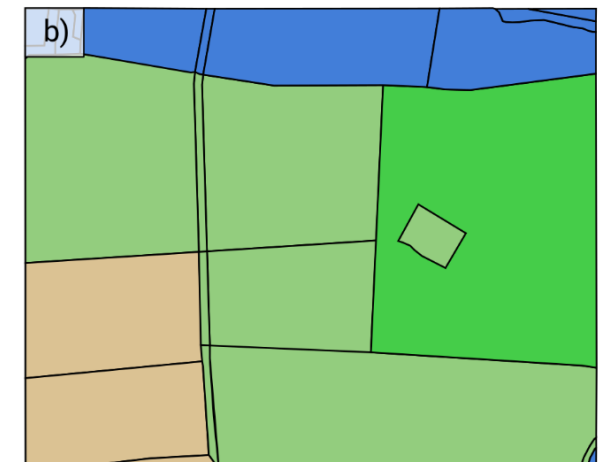


OPTAIN

SWAT+ COCOA MODEL SETUP



original soil input layer



Dominant soil aggregation
(SWATbuildR)

(Figures: Schürz al. 2022)

SWAT MODELLING AND SOIL DATA

Default: USDA soil databases

- State Soil Geographic database (STATSGO, 1:250,000)
- Soil Survey Geographic database (SSURGO, 1: 15,840 to 1: 31,680)

Outside USA :

- local/ regional/ national soil maps
- ISRIC SoilGrids (250m)
- Digital Soil Map of the World (DSMW, 1:5,000,000)

Challenge for Switzerland: lack of local/ regional/ national soil maps

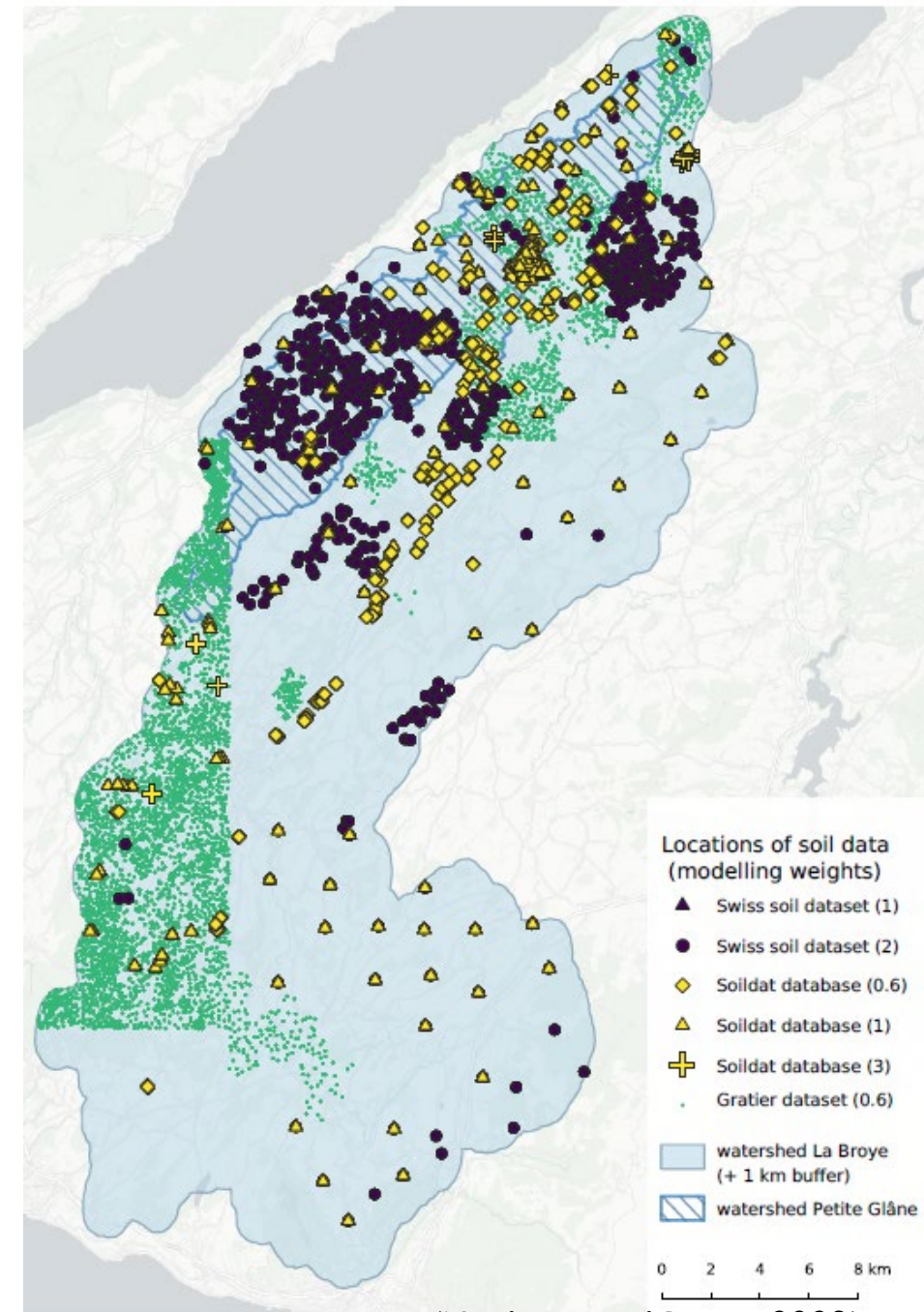
Swiss SWAT projects:

- Glaciated areas, soil played a negligible role (Rahman et al. 2013, Omani et al. 2017a, 2017b).
- Soil Suitability Map (BFS 2020)
→ interpretations regarding crop suitability (Abbaspour et al. 2007, Rahman et al. 2014, 2015, Andrianaki et al. 2019, Zarrineh et al. 2018, 2020)

SOIL DATA IN SWITZERLAND

Different soil data available

- Swiss Soil dataset: Canton of Fribourg, fully sampled profile pits, mapping campaign (1983-1993) and soil monitoring network
- Gratier dataset: Canton of Vaud, mostly observed by manual auger and broad description of some key soil properties
- Soildat database: surveyed within multiple Projects, mostly observed by manual auger with field estimates

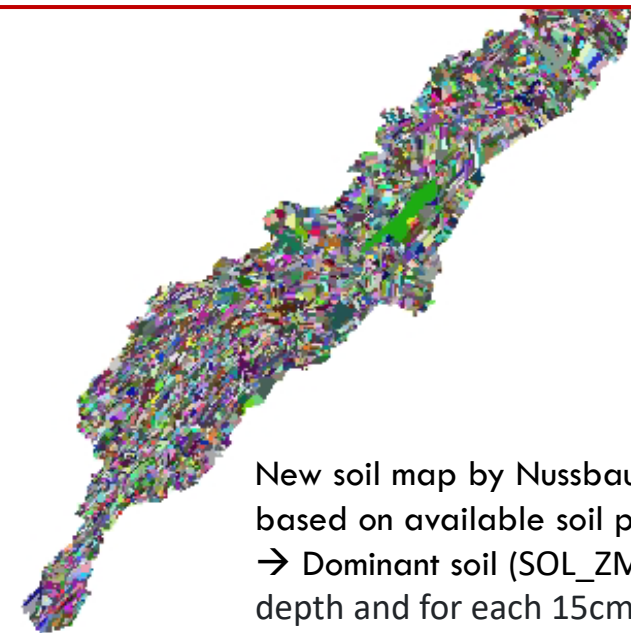
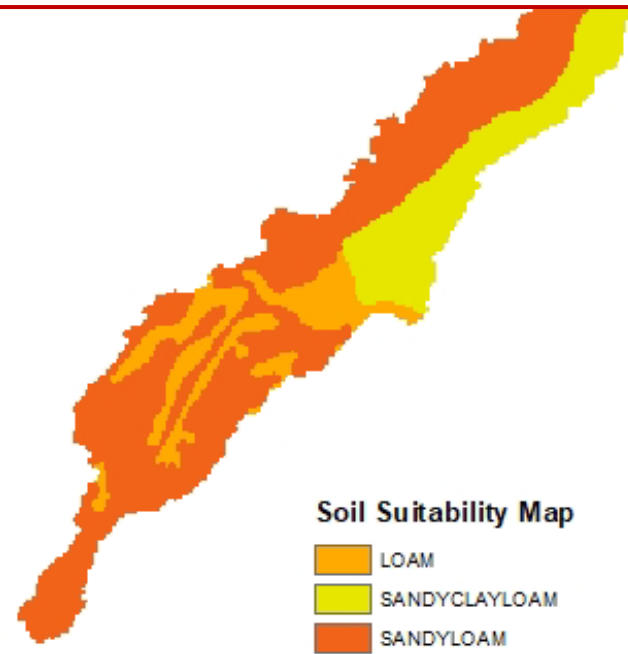
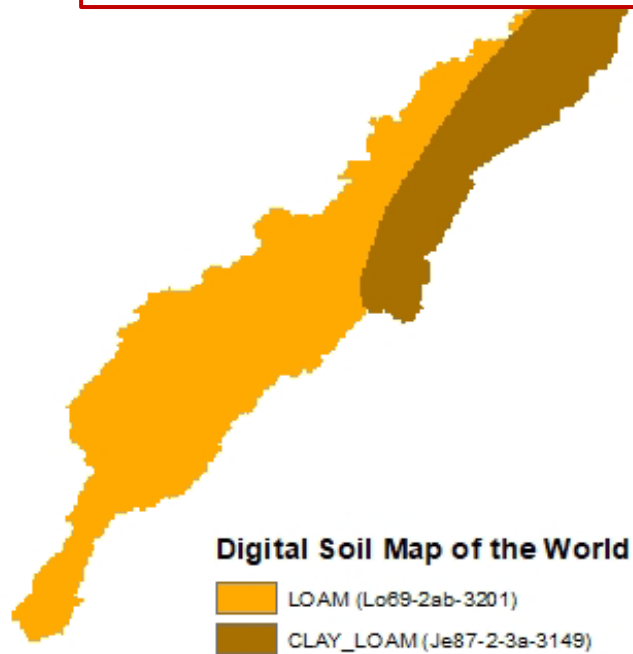


(Nussbaum and Burgos 2023)

SOIL MAPS FOR SWAT MODEL IN PETITE GLÂNE

How does the resolution of soil data impact simulation of river discharge in SWAT+ with COCOA?

→ Compare simulation results to measured river discharge (before and after calibration)



New soil map by Nussbaum and Burgos (2023) based on available soil profile data
→ Dominant soil (SOL_ZMX, impervious layer depth and for each 15cm Clay, Silt, Sand, Rock, SOL_CBN)

SWAT MODELLING AND DATA RESOLUTION

17 results from Web of Science Core Collection for

Q SWAT, resolution, DEM (Title)

[Copy query link](#)

Publications

You may also like...

[Back to all filters](#)

Refine by Publication Years

Search for Publication Years

Select all

- | | |
|-------------------------------|---|
| <input type="checkbox"/> 2022 | 1 |
| <input type="checkbox"/> 2020 | 2 |
| <input type="checkbox"/> 2019 | 3 |

9 results from Web of Science Core Collection for:

Q SWAT, resolution, Soil (Title)

[Copy query link](#)

Publications

You may also like...

Analyze Results

Citation Report

 Create Alert

[Back to all filters](#)

Refine by Publication Years

Search for Publication Years

Select all

- | | | | | | |
|-------------------------------|---|-------------------------------|---|-------------------------------|---|
| <input type="checkbox"/> 2021 | 1 | <input type="checkbox"/> 2016 | 1 | <input type="checkbox"/> 2008 | 1 |
| <input type="checkbox"/> 2020 | 1 | <input type="checkbox"/> 2010 | 1 | | |
| <input type="checkbox"/> 2018 | 2 | <input type="checkbox"/> 2009 | 2 | | |

Date 

IMPACT OF SOIL MAP RESOLUTION ON SWAT

Number and size of HRU

→ SWAT+ COCOA: HRUs defined by land use/ land cover map

Coarser maps performed better **before calibration**, finer better after (Geza and McCray 2008, Kumar and Merwade 2009, Bhandari et al. 2018, Busico et al. 2020)

→ calibration process neutralises the impact of soil data resolution (Kumar and Merwade, 2009)

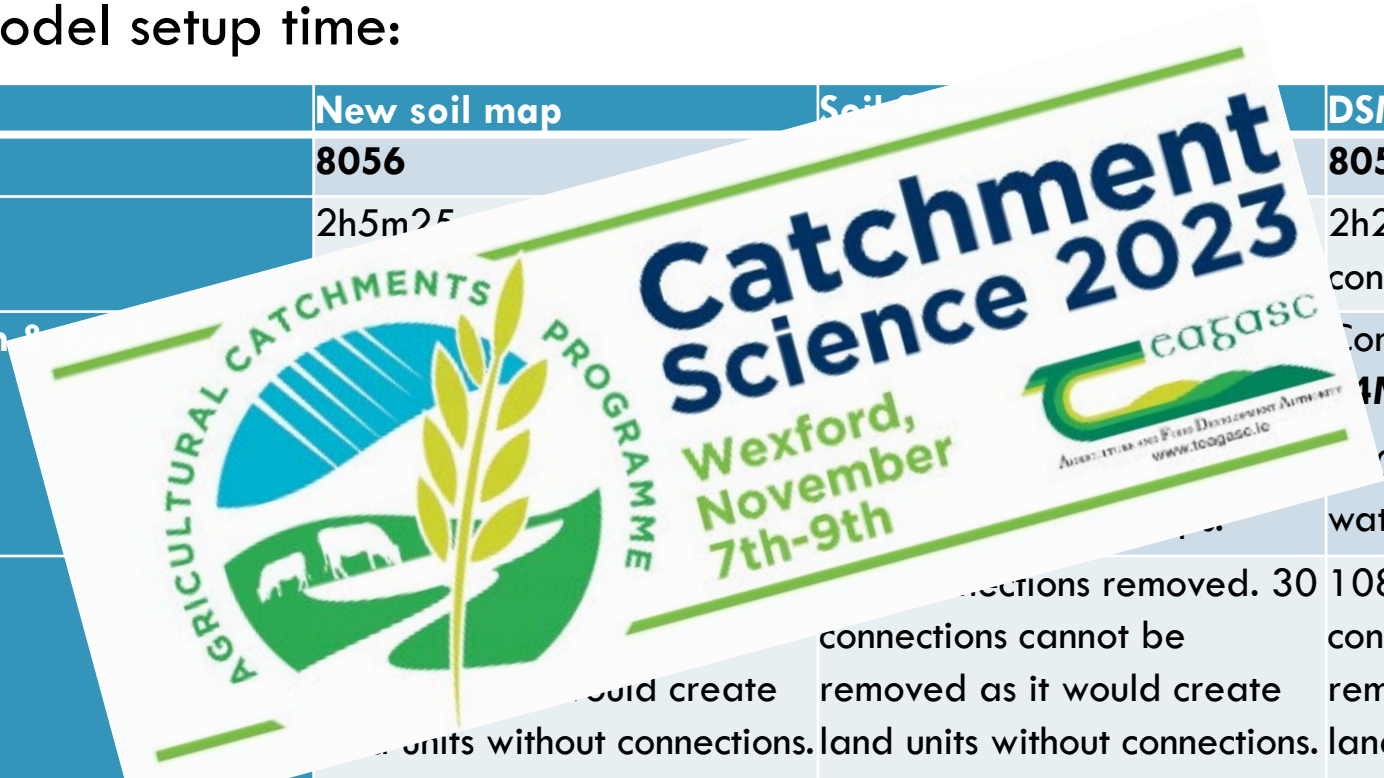
Finer soil maps need **time and effort**, e.g. for calibration (Bhandari et al. 2018)

IMPACT OF SOIL MAP RESOLUTION ON SWAT

First insights:

SWATbuildR model setup time:

	New soil map	Soil	DSMW
Total Land Object (LO)	8056		8056
LO Connectivity	2h5m25s		2h2m37s, 183 LO with no connection
Reduce land connection for infinite loop routing			Completed 7873 LO in 1H 1M 15S, 10 LO identified where water is routed in loops
resolve_loop_issues			108 connections removed. 28 connections cannot be removed as it would create land units without connections.





THANK YOU FOR YOUR ATTENTION!



JOANA.EICHENBERGER@UNIBE.CH