



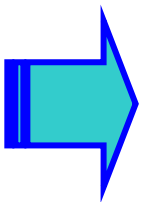
## **A new 'floodland' module in the SWAT codes for the simulation of periodically wet areas**

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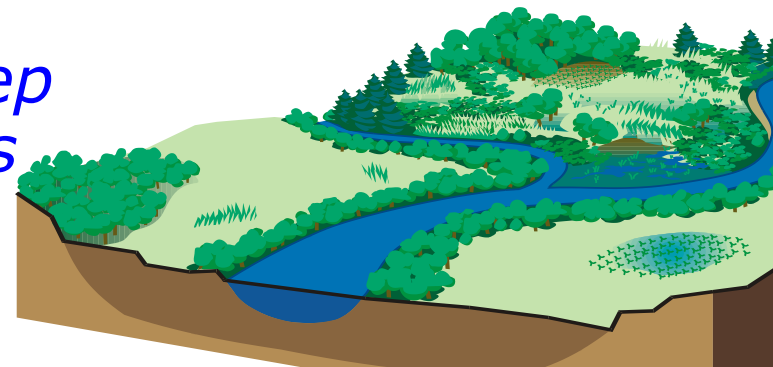
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# Soil and Water Assessment Tool

- Simulation of processes at land and water phase
- Spatially distributed (different scales)
- Semi physically based / empirical approaches
- Simulation of changes (climate, land use, management etc.)
- **Water quantities**, incl. different runoff components
- **Water quality**: Nutrients, Sediments, Pesticides, Bacteria, (algae and oxygen), etc.



*.... all that on a daily time step  
and at different spatial scales  
and (more or less) readily  
available data sets!!*

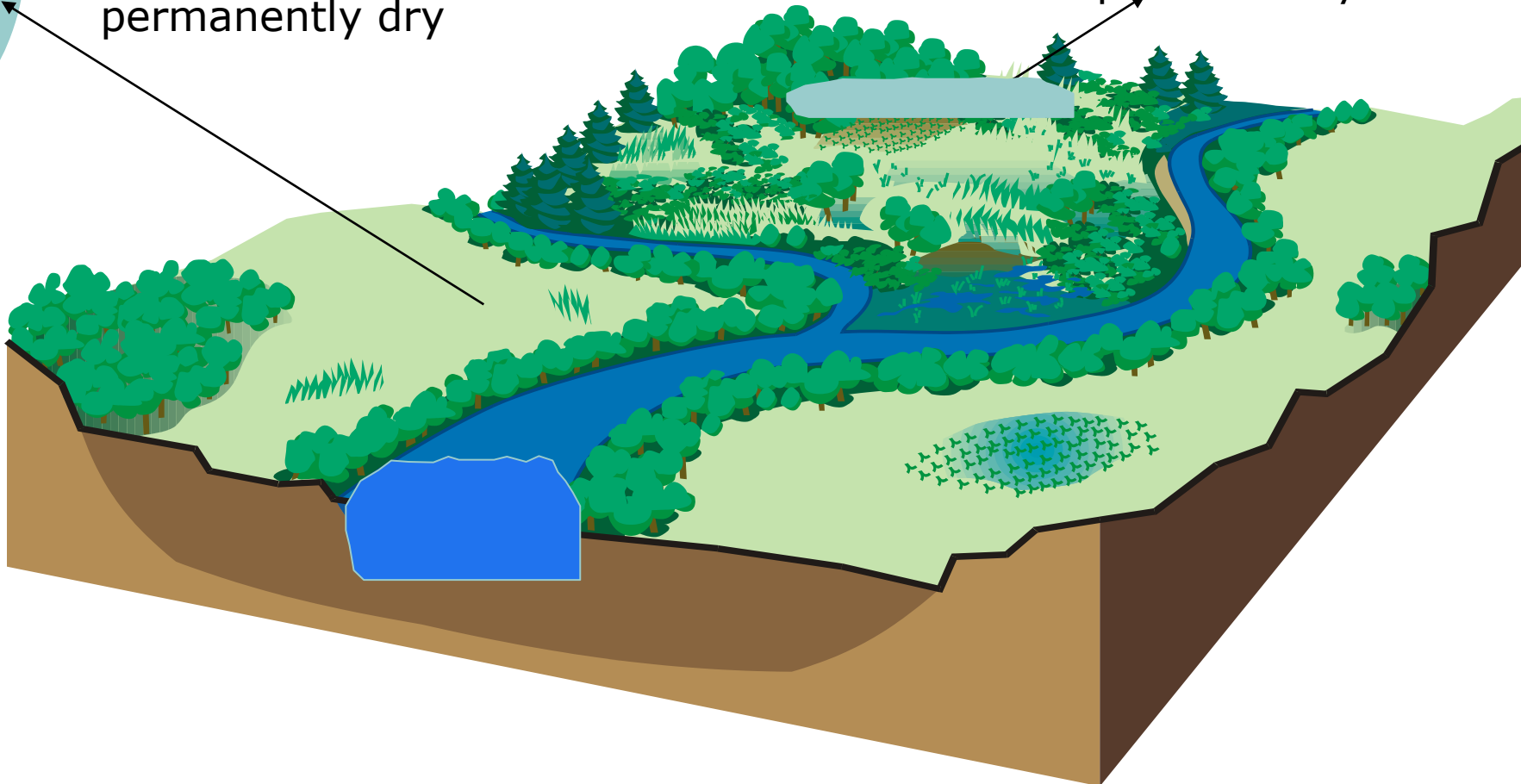


# Landscape units: land or water



Land: agricultural, urban, natural  
permanently dry

Water: river, pond, reservoir  
permanently wet



# Water in the landscape

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Wet areas:

**Land:** HRU (floodplains, potholes); ponds and wetlands

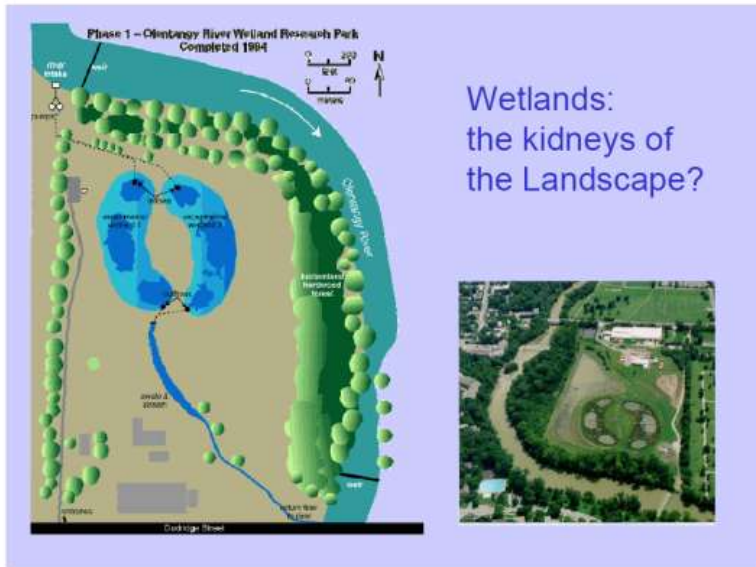
**River:** reservoirs/lakes

Water balance in wetlands, ponds and reservoir is computed using the equation:

$$V = V_{stored} + V_{flowin} - V_{flowout} + V_{pcp} - V_{evap} - V_{seep}$$

- $V$ : Volume of water in impoundment in m<sup>3</sup>
- $V_{stored}$ : Volume of the water stored in the water body at the beginning of the day in m<sup>3</sup>
- $V_{flowin}$ : flow entering the water body during the day.
- $V_{flowout}$ : flow flowing out.
- $V_{pcp}$ : Volume of precipitation falling on the water body.
- $V_{evap}$ : removed from water body by evaporation
- $V_{seep}$ : Volume of water lost by seepage

# Temporary wet areas





# Temporary wet areas



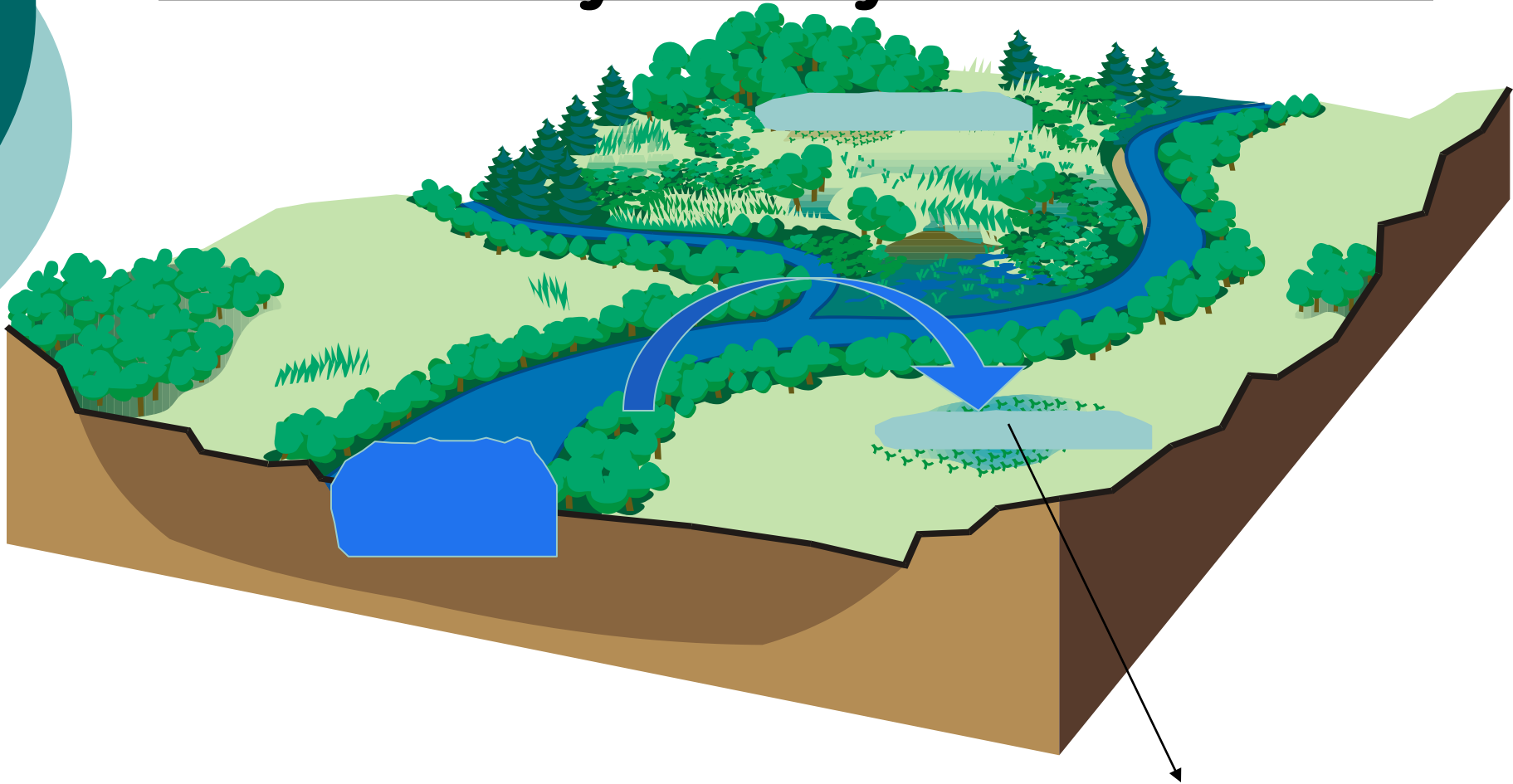
# Problem

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- Good calibration only with very low curve numbers
  - Little surface runoff
  - Not realistic
- > need to adapt SWAT for temporarily storage of water

# New unit: floodland = temporary wet/dry

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Wetlands. Floodplains, paddy fields, potholes



# FLOODLAND-module

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Flood occurrence, depending on type (eg. Paddy field, riverine wetland, floodplain,...) in order to define the FLOOD\_HRU variable that defines the fraction of wet area

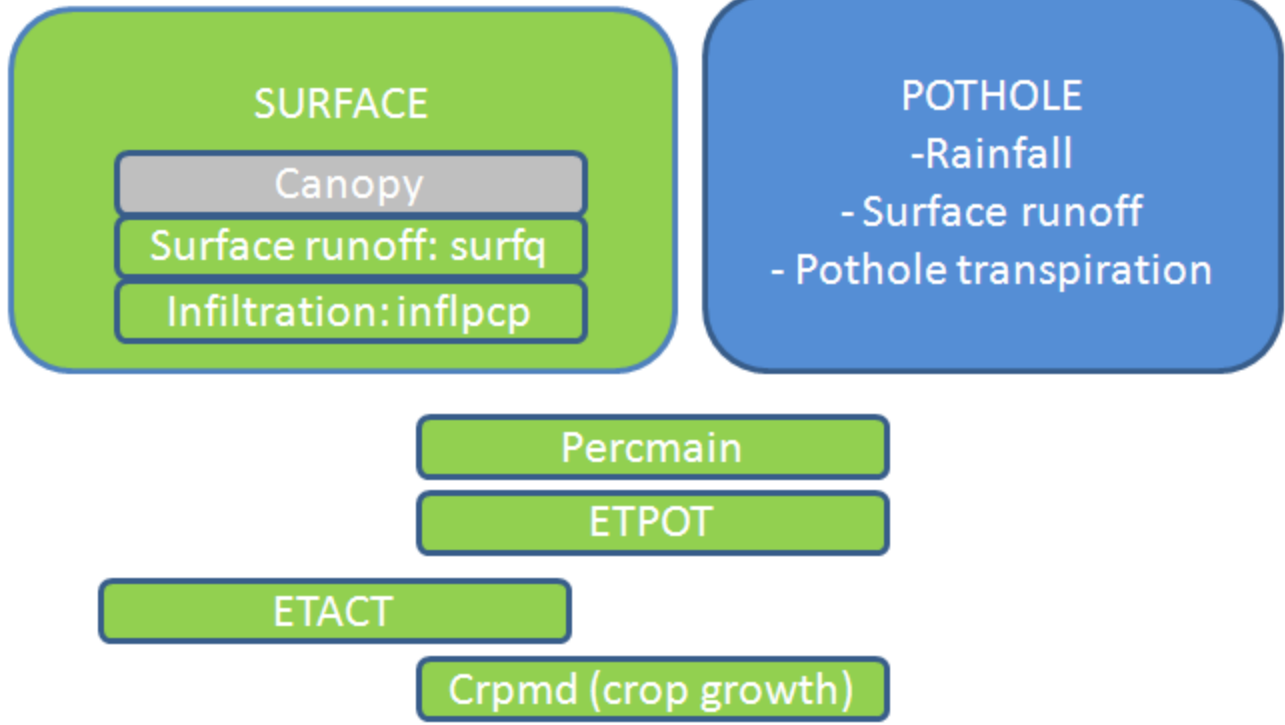
## Splitted routines for

Wet fraction -> wet HRU processes (cfr potholes)

- (1) Free water evaporation
- (2) Hydraulic conductivity for groundwater recharge
- (3) Overtopping (>maximum volume) gives surface runoff

Dry fraction -> normal HRU processes

pot\_vol(j) < 1.e-3 .and.  
imp\_trig(nro(j),nrelease(j),j)==1



# Modified

ETPOT with new open water module

FLOOD\_HRU: computation of wet area fraction

SURFACE

Canopy

Surface runoff: surfq

Infiltration: inflpcp

FLOODLAND

Surface runoff from dry areas to wet  
Rainfall on wet area  
Seepage to soil water for wet area:  
potsepm  
Spilling over/release

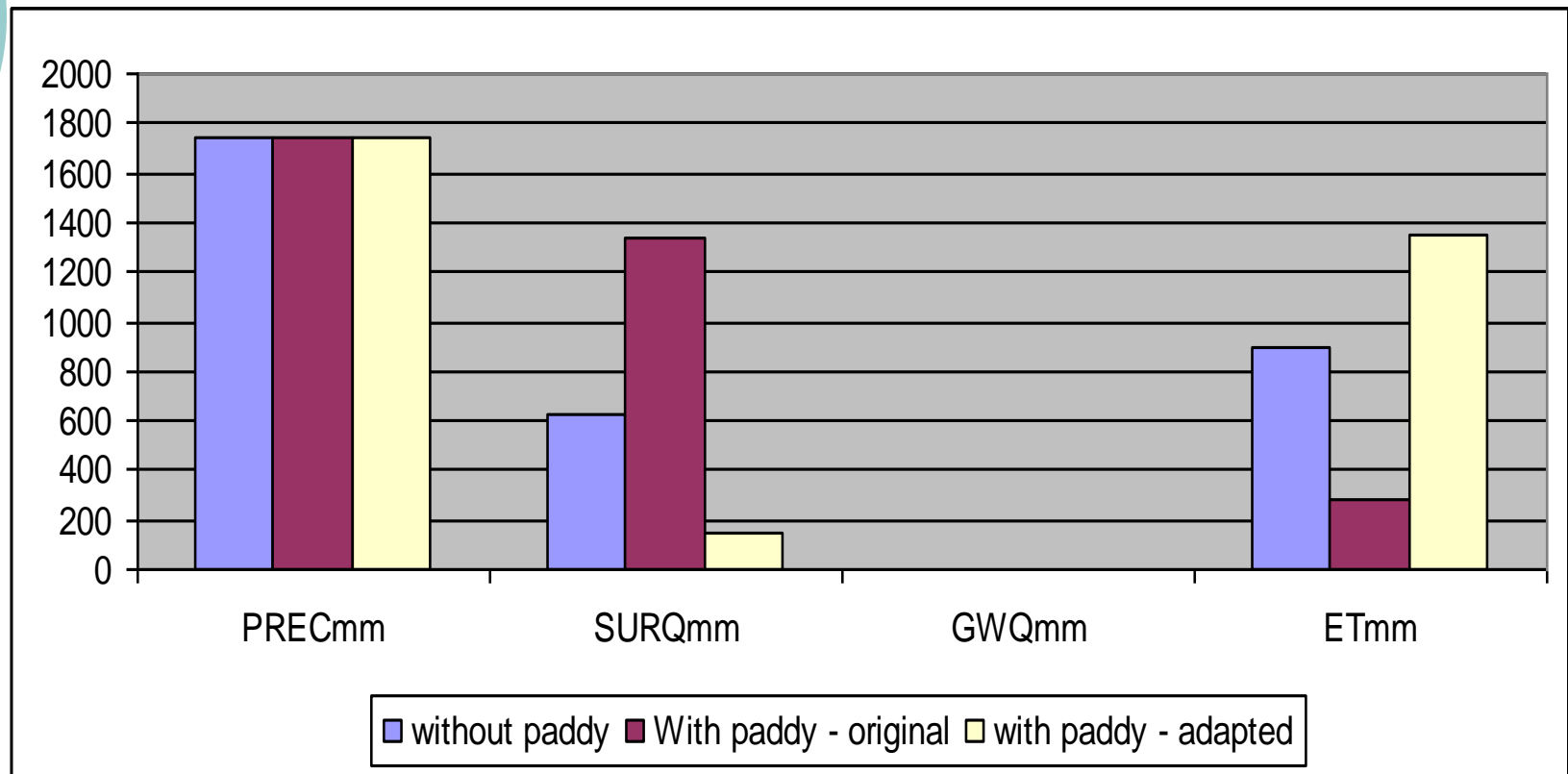
Percmain with  $(\text{inflpcp} * 1 - \text{flood\_hru}) + \text{potsepm}$

Etact to compute canev (for entire HRU), es\_day,  
[ $\text{eosl} = \text{esleft} * (1 - \text{flood\_hru}(j))$ ]

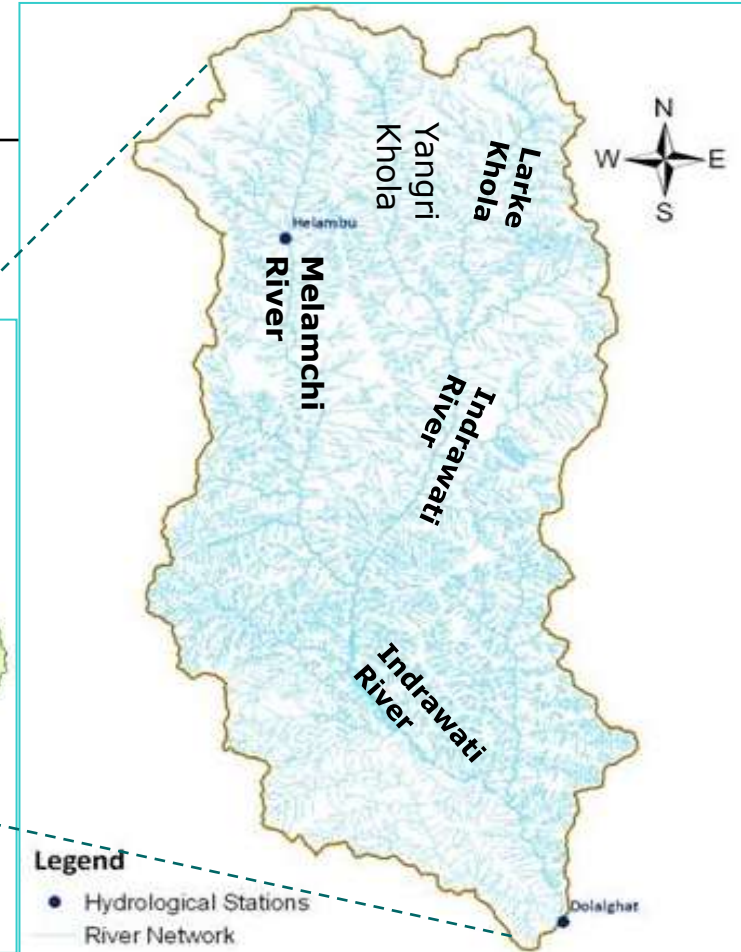
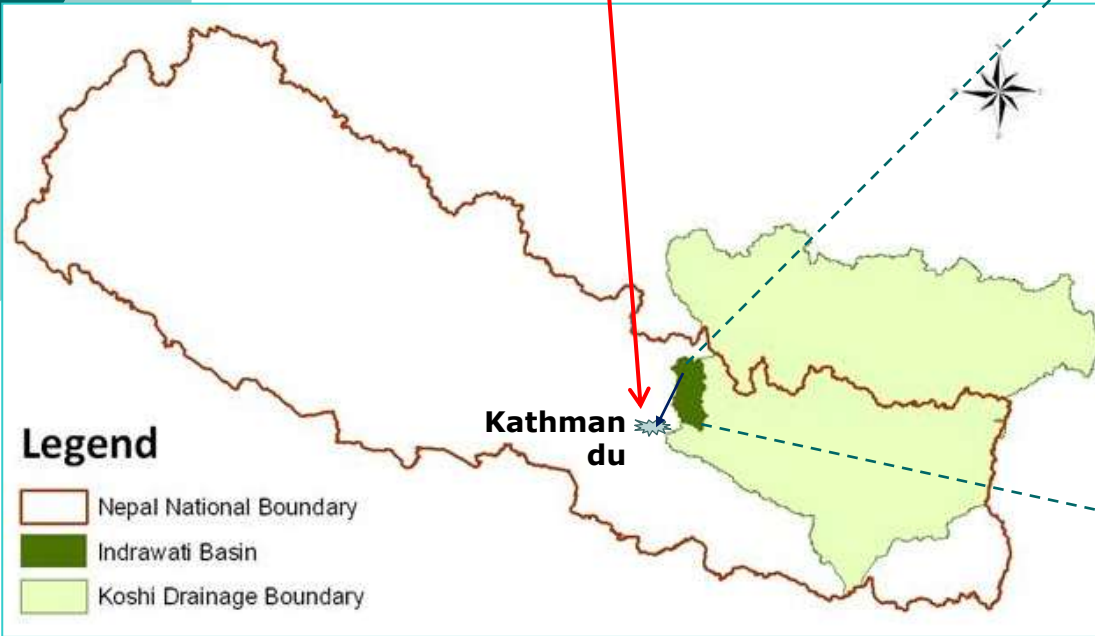
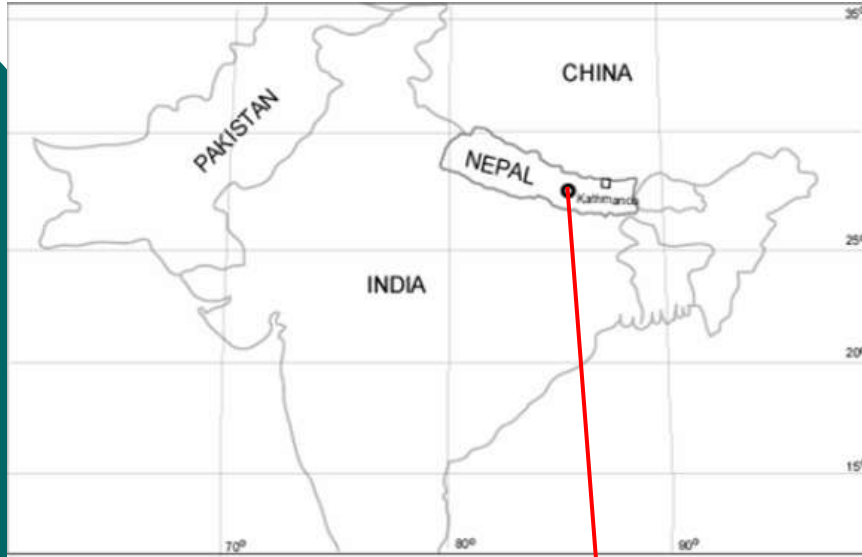
Plantmod computation of ep\_day for entire HRU

$\text{Etday} = \text{es\_day} + \text{ep\_day} + \text{potevmm} + \text{canev}$

# Results for paddy field



# Catchment scale: Indrawati river basin

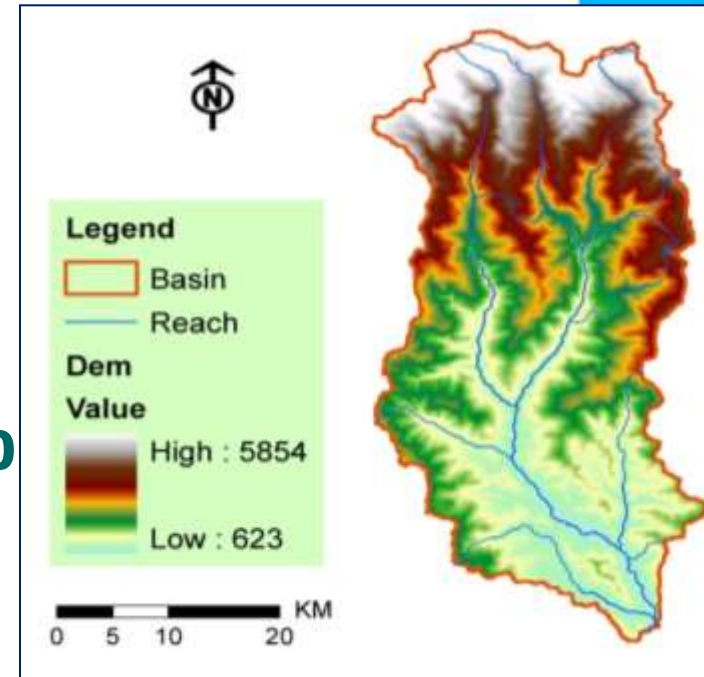




# Indrawati river basin

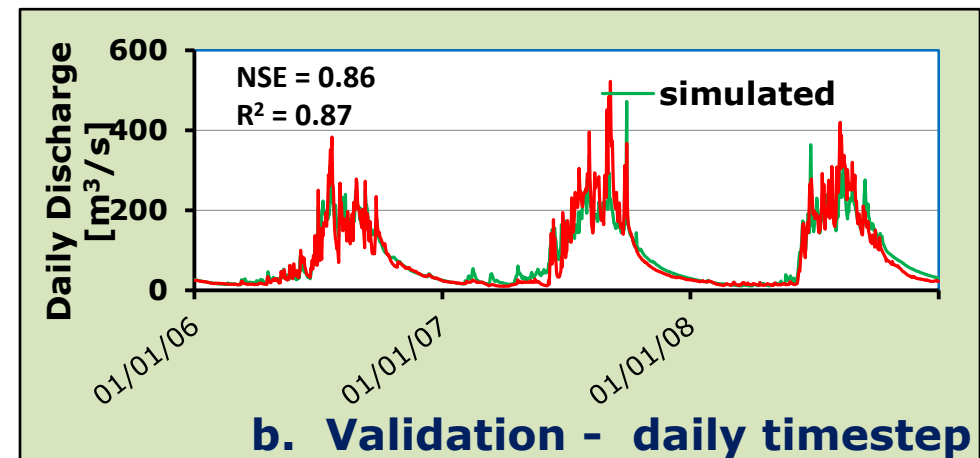
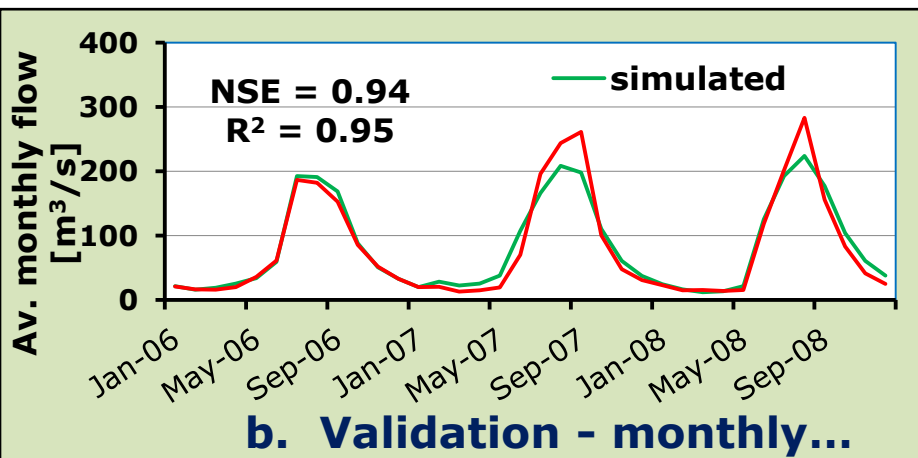
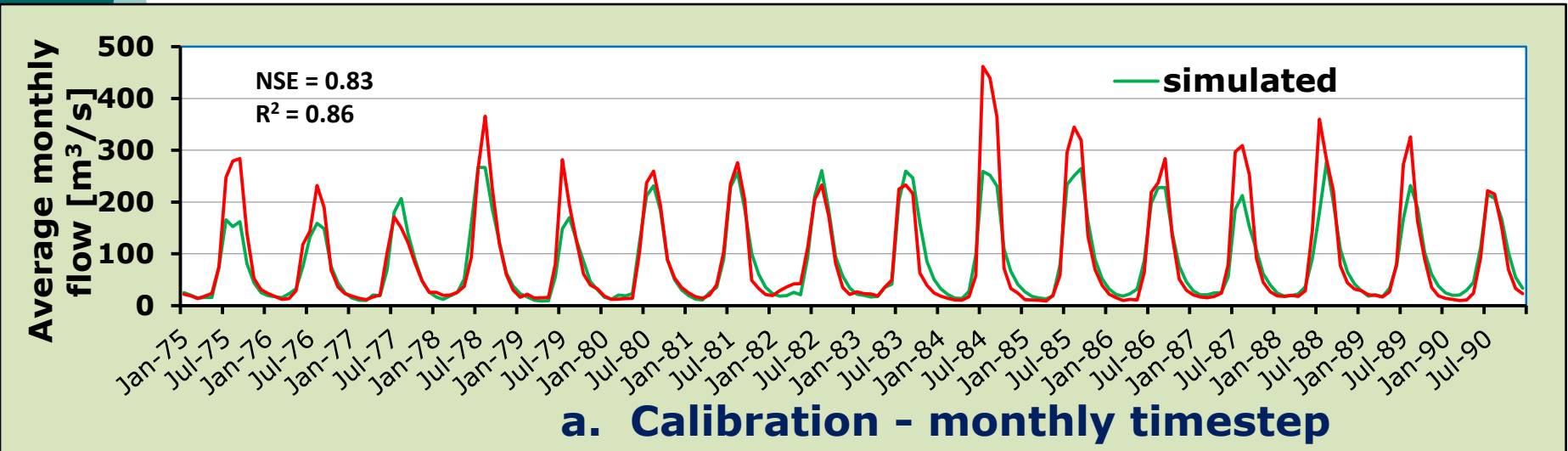
## Basin Introduction

- Catchment: 1228 km<sup>2</sup>
- Elevation: 5860 to 623 m asl
- Climate: sub-tropical to alpine
- Precipitation: 2900 mm/a (3600 mm at higher elevation and 1100 mm at lower elevation)
- Av. potential ET: 930 mm/a

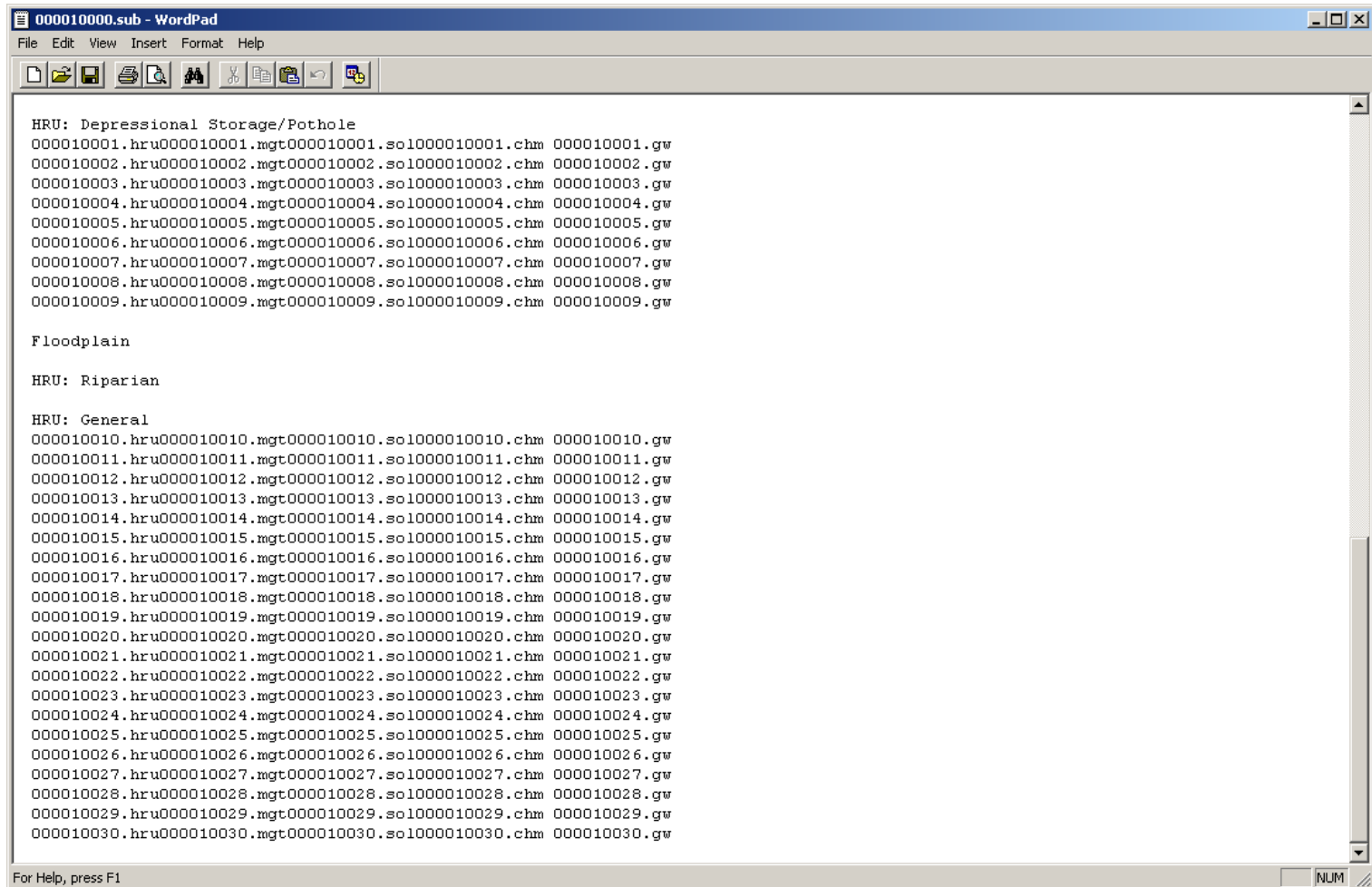


- More than 90 % of the population involved in agriculture
- Rice (~70%)
- Also Wheat, Maize, Millet, Potato

## Calibration / Validation Results: Indrawati basin outlet



# Multiple pothole HRU's



000010000.sub - WordPad

File Edit View Insert Format Help

HRU: Depressional Storage/Pothole

000010001.hru000010001.mgt000010001.sol000010001.chm 000010001.gw  
000010002.hru000010002.mgt000010002.sol000010002.chm 000010002.gw  
000010003.hru000010003.mgt000010003.sol000010003.chm 000010003.gw  
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000010008.hru000010008.mgt000010008.sol000010008.chm 000010008.gw  
000010009.hru000010009.mgt000010009.sol000010009.chm 000010009.gw

Floodplain

HRU: Riparian

HRU: General

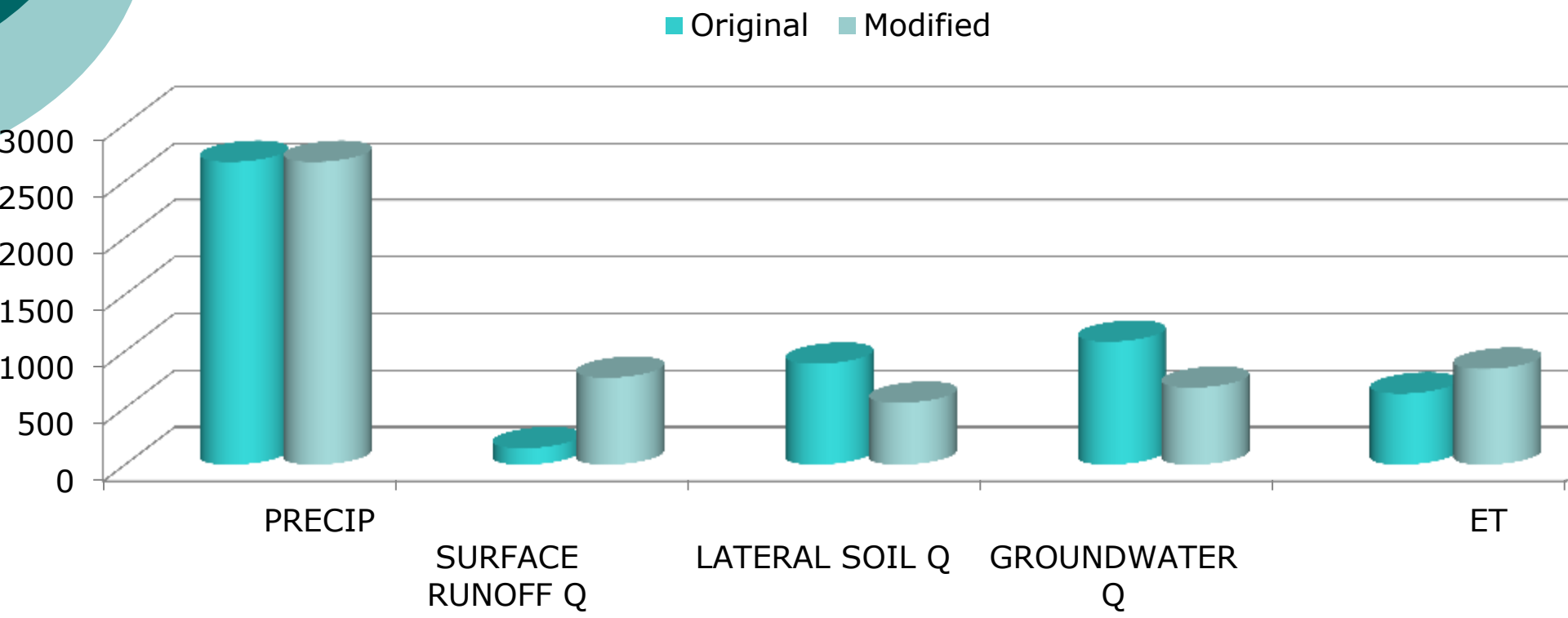
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For Help, press F1

NUM



# Results for the Indrawati catchment



# Conclusion

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Generic floodmodule has been presented, that can be used for temporary and partially wet areas, such paddy fields and wetlands

Adaptations needed to current paddy field

Strong effect to hydrology

To be done:

- Water quality processes
- Floodplain events