Impact of Land Use changes on Runoff in a Representative Basin in the Semiarid of Pernambuco State Using the SWAT Model

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- Water scarcity in semi-arid regions of northeastern Brazil is a limiting factor for economic and social development factor.

Semiarid vegetation

Wet season

Dry season

Alluvial Valleys

- Irrigation

Objective

- The objective of this work is to investigate the impact of land use and land cover changes on the catchment scale using the SWAT model, mainly the desforestation impacts on water avaliability.

Ipanema watershed

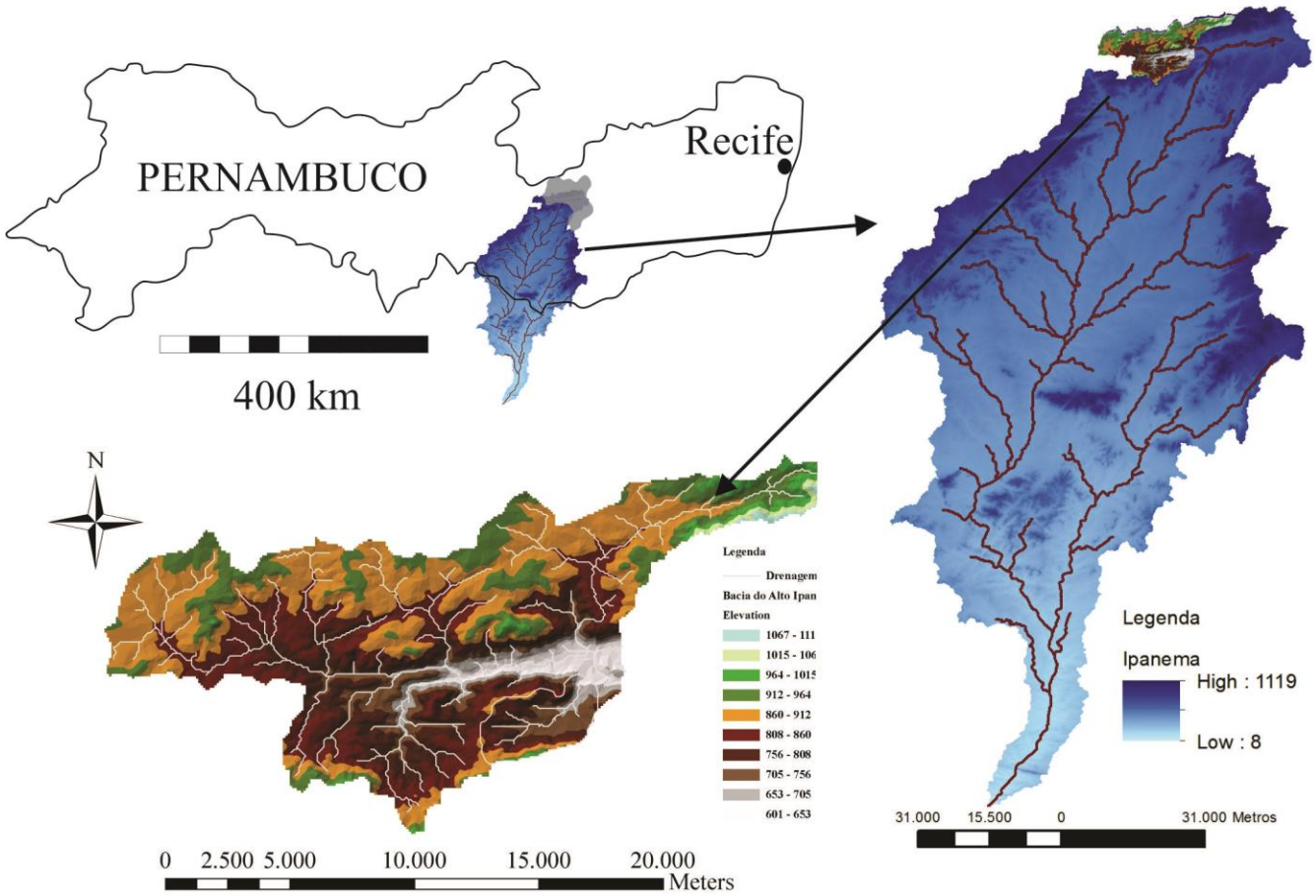
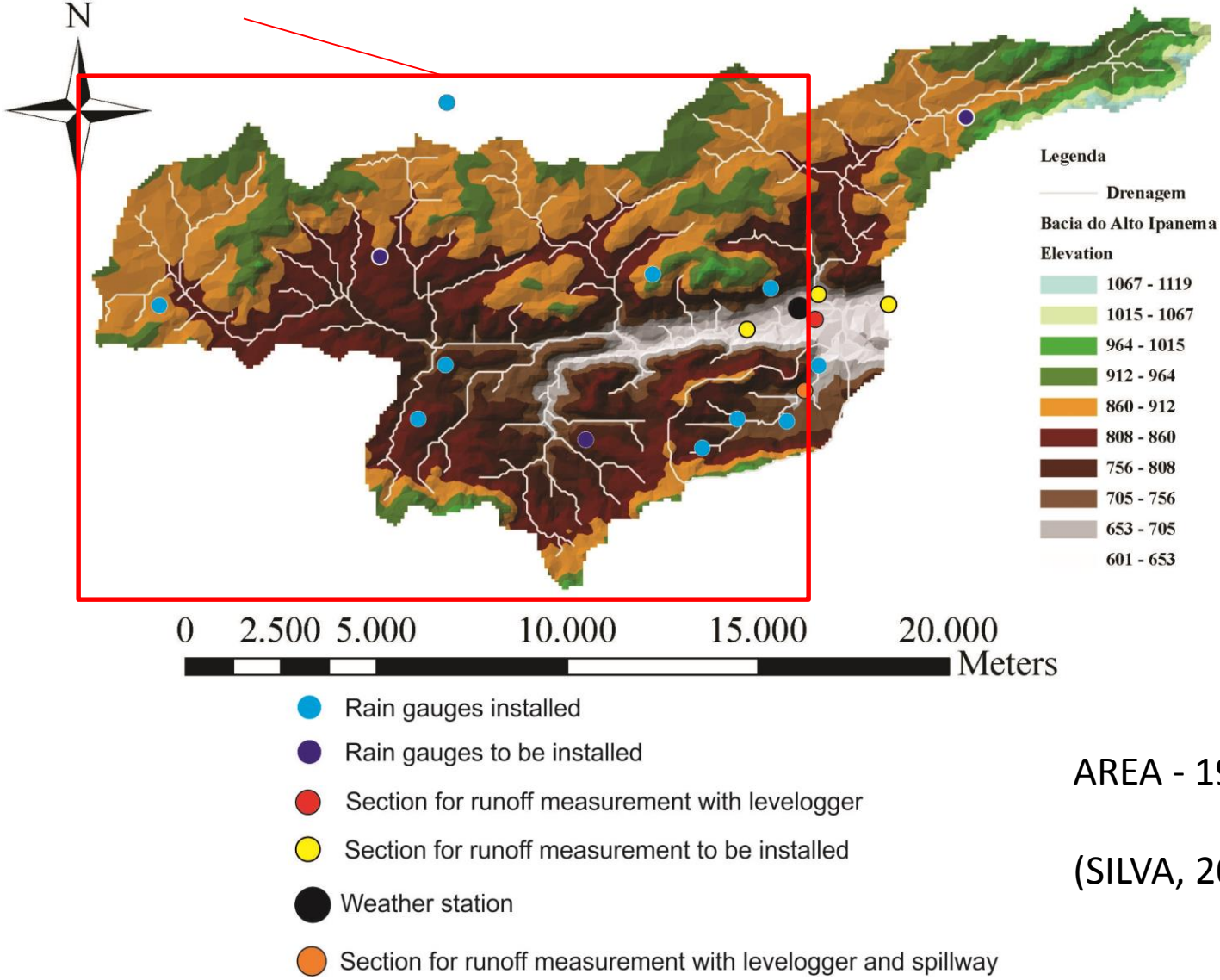


Figure 1. Location Alto Ipanema Basin in Ipanema Basin in the state of Pernambuco

MIMOSO SUB-BASIN



AREA - 194 km²

(SILVA, 2010)

A.

C.

E.

B.

D.

Figura 2. Equipaments installed: weather station(A), Rain gauges HOBO(Onset) (B), Manual raingages (C), Data logger for levelogger and raingage (D) e Manual Ville de Paris raingage (E).

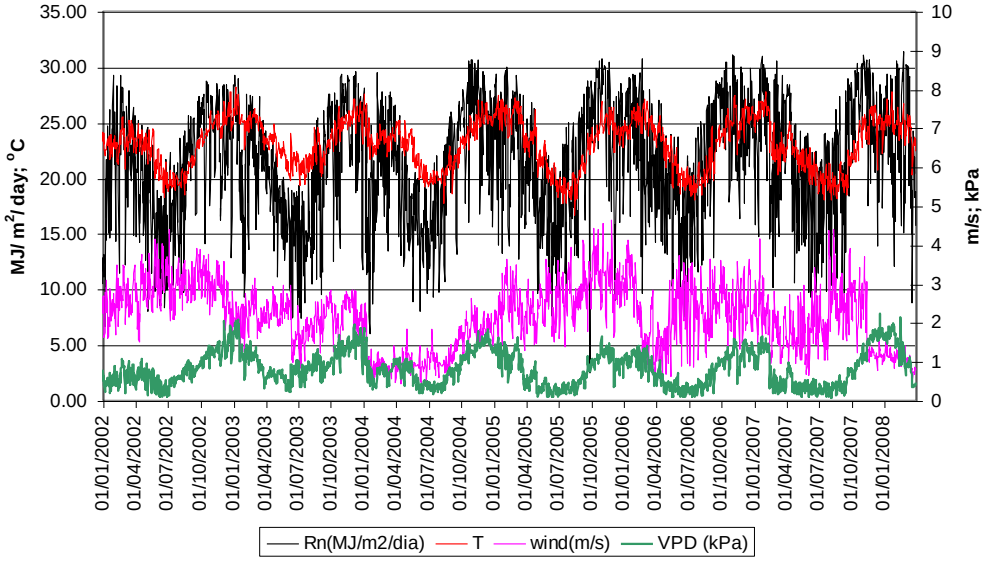
- Piezometers
- 6 and 10 meters depth
- 1 inch (diameters)
- Leveloggers – 5 m depth
- 10 years manual montlhy
- 2 years automatic sub-daily

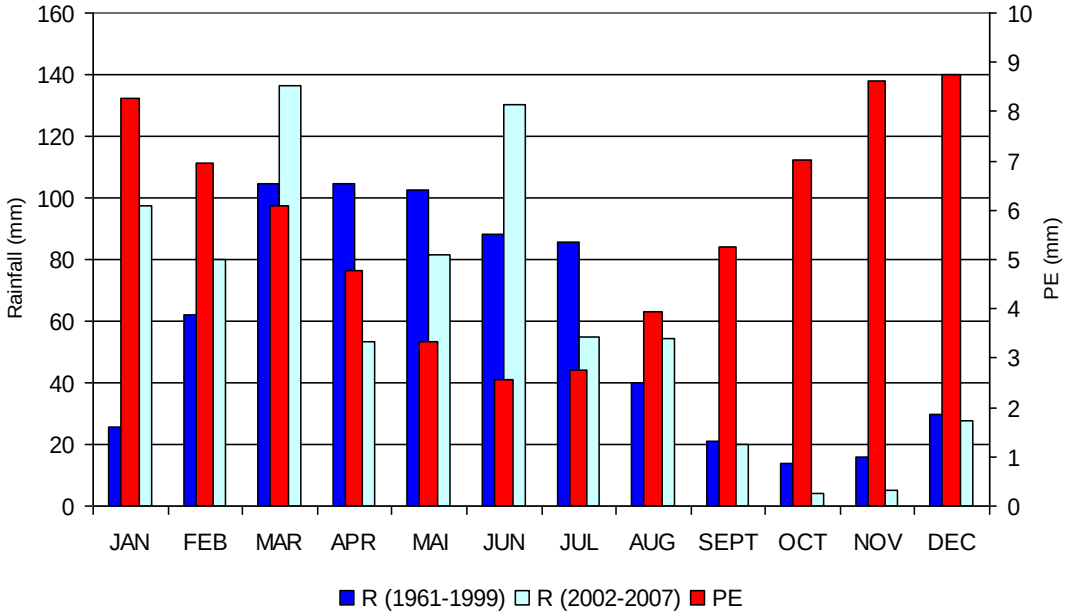
Climate info

- BSsh (very hot, semiarid) - Köppen, com
- Precipitation – 730 mm total year
- Evapotranspiration – 1683 mm total year

– (MONTENEGRO & MONTENEGRO, 2006)

Climate info



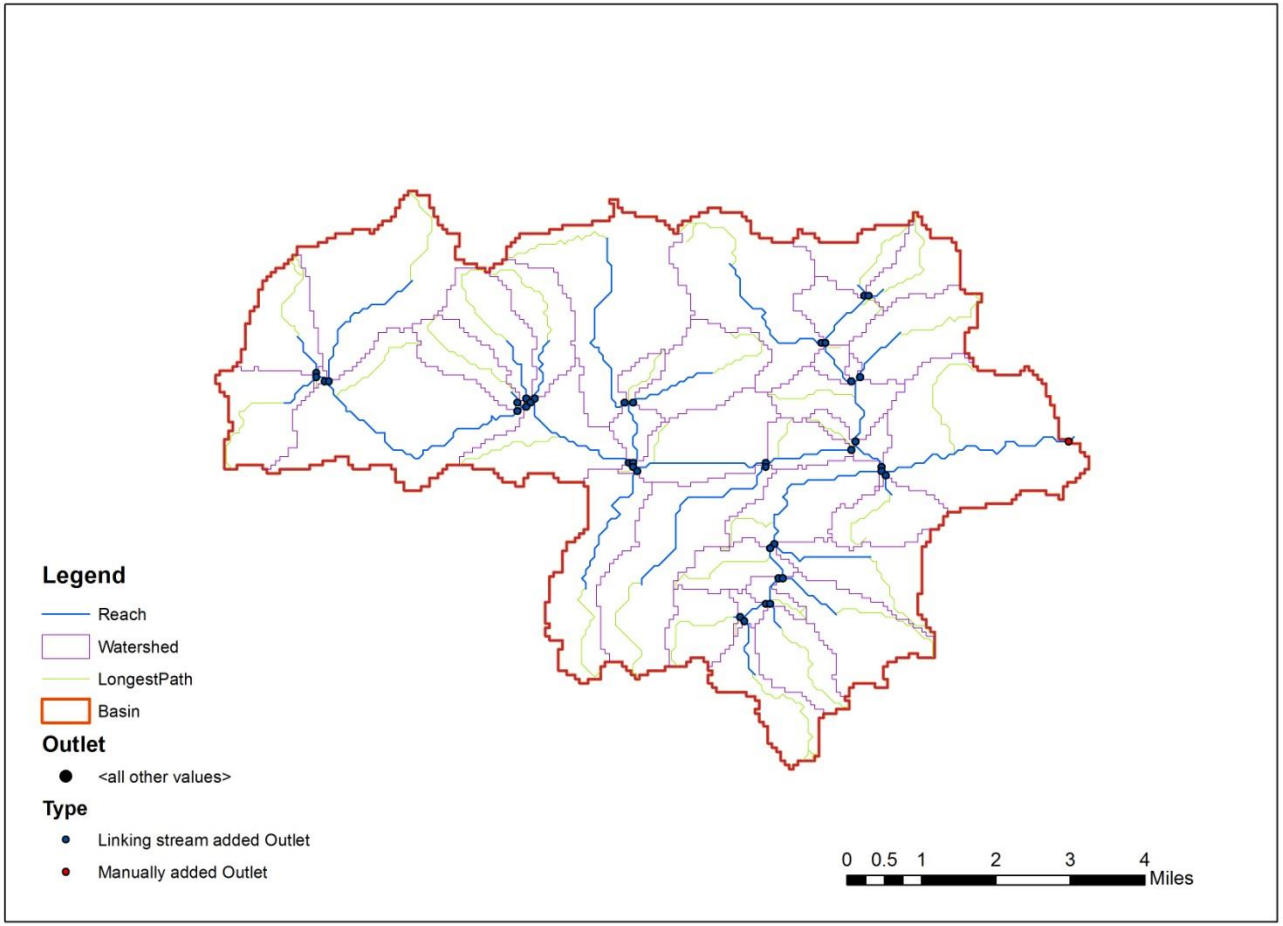


MODELLING STUDY

ArcSWAT 2009

SWAT-CUP

WATERSHED DELINIATION



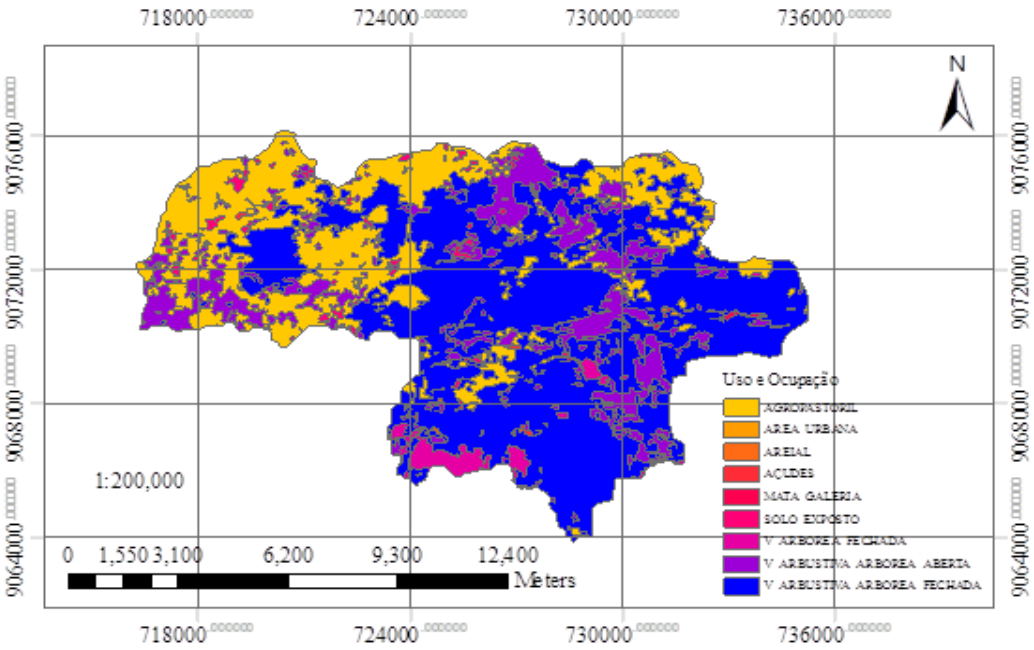
38 sub-basins

270 ha

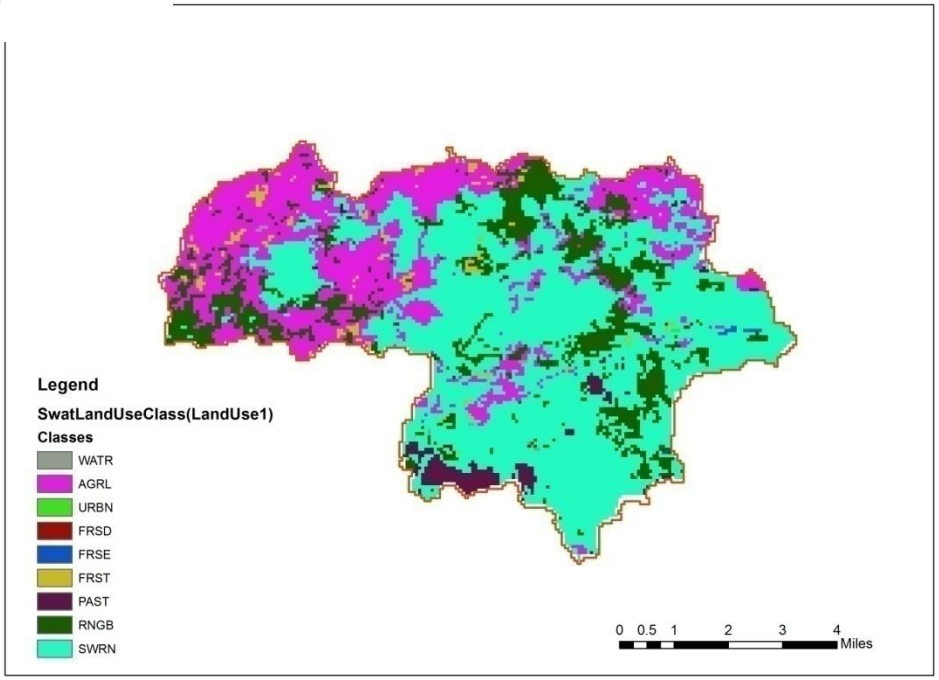
SRTM – 90 X 90
(EMBRAPA – site)

Area - 125 km²

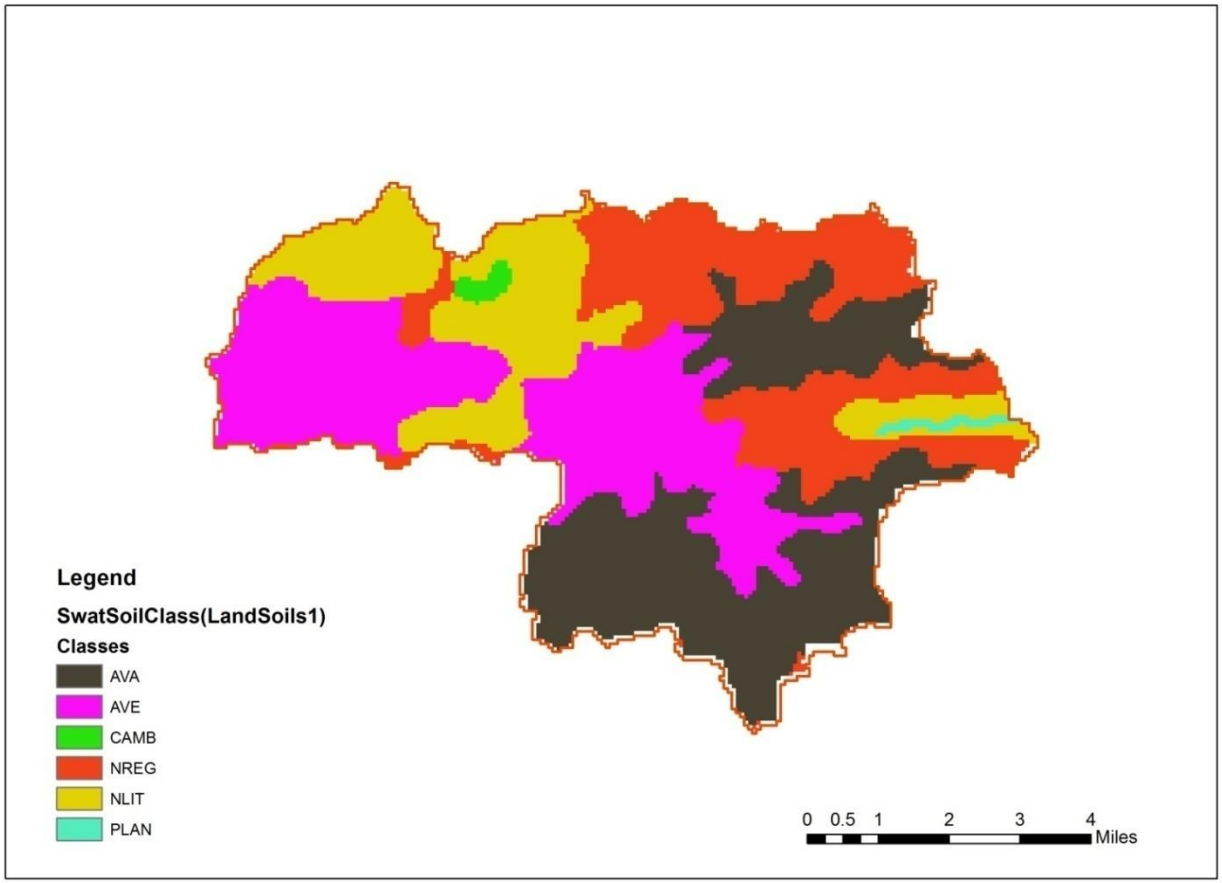
Landuse



WATER-> Açudes (Reservatórios)
ARGL -> Agricultura
FRSD -> Mata Galeria
RNGB -> Mata arbustiva
SWRN -> Caatinga Arb. Aberta
PAST -> Pasto
FRST – > Caartinga Arb. Fechada
URBN – > Áreas Urbanas e Areial



Soils



- Red argisol
- Red-yellow argisol
- Cambisol
- Regolithic neosol
- Litholic neosol
- Fluvic neosol
- Planosol

EMBRAPA
(1: 250,000)

- Climate data
  - Weather data - Estimate
  - Precipitation – raingage – 2000 -> 2012
- SLOPE –
  - 2, 5, 10 e 15 %

Parameters

5 [1] [All] | 5

Parameters:

	#	Basic Information: Par Name	File Name	File Ext.	Value: Method	Min	Max	H
▸	1	**CN2**		.mgt	Relative	-0.1	0.1	
	2	**ALPHA_BF**		.gw	Replace	0	1	
	3	**ESCO**		.bsn	Replace	0.7	0.95	
	4	**SOL_K**		.sol	Relative	-0.1	0.1	
	5	**GW_DELAY**		.gw	Absolute	-30	60	

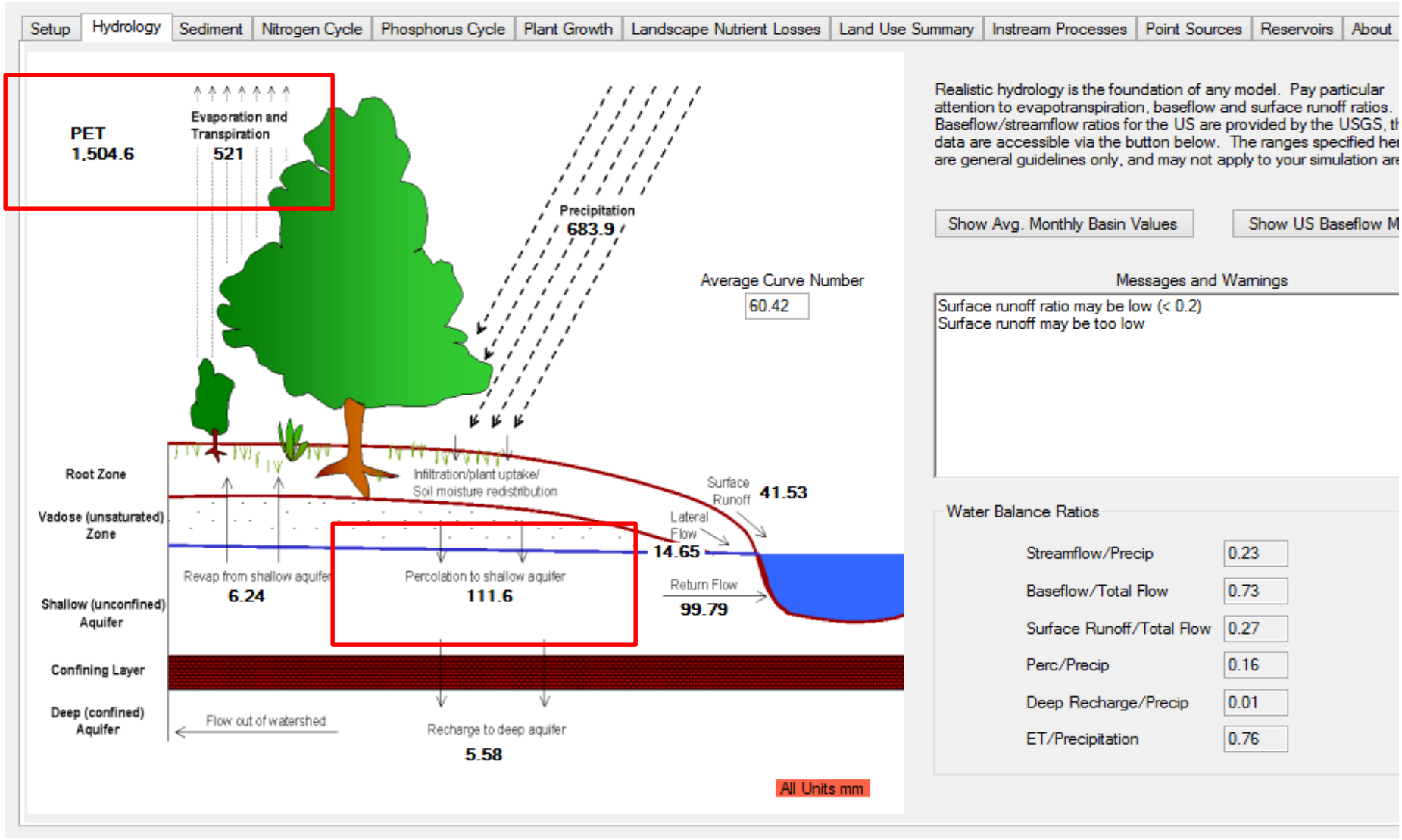
Observed data

- FLOW ALL SUB-BASINS (m^2/s)

```
5  FLOW_OUT_5_2002  0.0062
6  FLOW_OUT_6_2002  0.04122
7  FLOW_OUT_7_2002  0.027
26 FLOW_OUT_2_2004  2.0038
27 FLOW_OUT_3_2004  0.3309
29 FLOW_OUT_5_2004  0.025
30 FLOW_OUT_6_2004  0.8649
31 FLOW_OUT_7_2004  0.1963
```

Hydrology

(MONTENEGRO and RAGAB (2010)



Add Parameters

Number Of Parameters: 7 [1] [All]

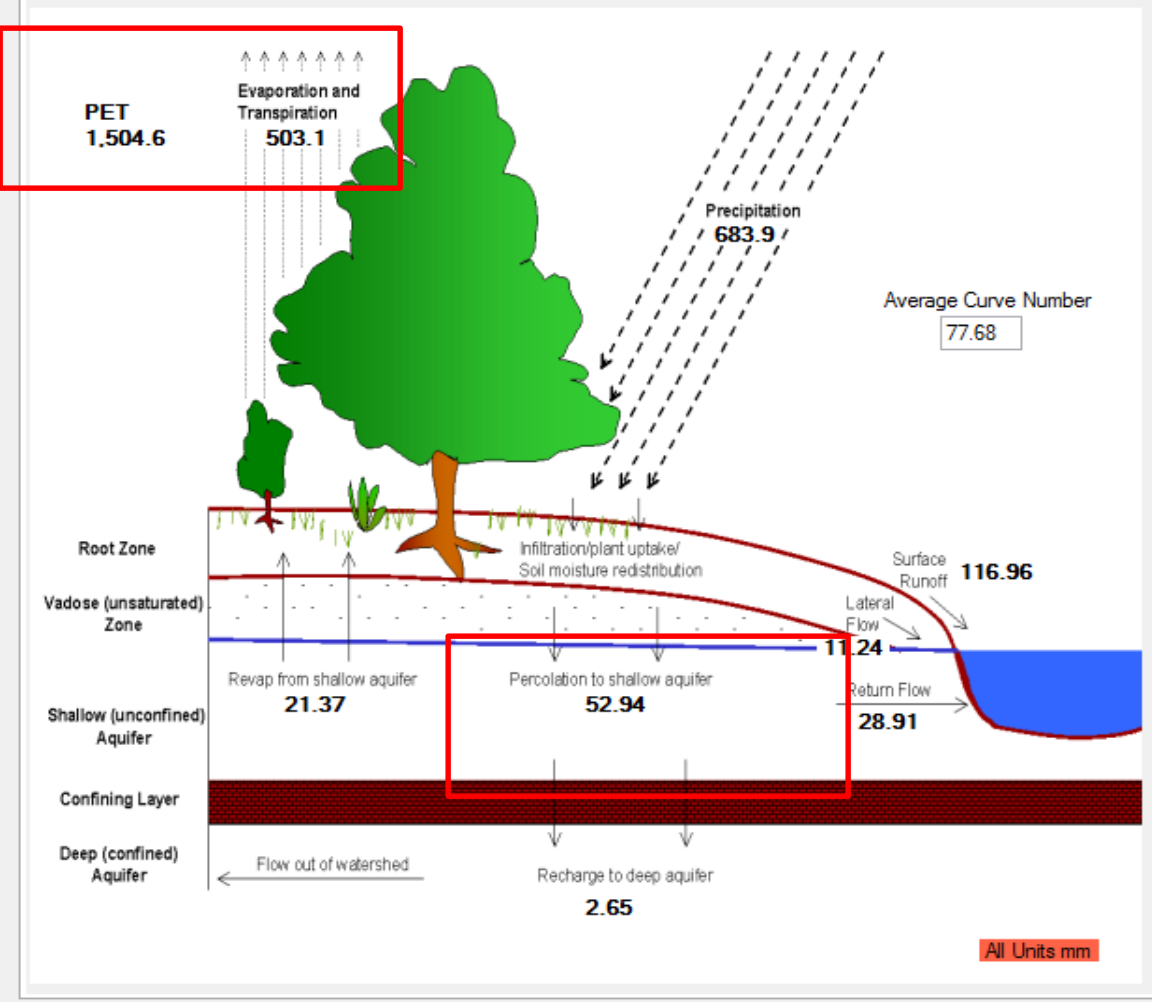
Number Of Simulations: 10

Parameters:

	#	Basic Information: Par Name	File Name	File Ext.	Value: Method	Min	Max	Hydro
▸	1	CN2		.mgt	r Relative	-0.3	0.3	
	2	ALPHA_BF		.gw	v Replace	0	1	
	3	ESCO		.bsn	v Replace	0.4	0.95	
	4	SOL_K		.sol	r Relative	0.001	0.1	
	5	RCHRG_DP		.gw	v Replace	0	0.5	
	6	GW_DELAY		.gw	a Absolute	-30	450	
	7	CANMX		.hru	r Relative	0	10	
	8	GWQMN		.gw	v Replace	0	2	
	9	GW_REVAP		.gw	r Relative	0	0	
	10	REVAPMN		.gw	r Relative	0	0	

Hydrology

Setup | Hydrology | Sediment | Nitrogen Cycle | Phosphorus Cycle | Plant Growth | Landscape Nutrient Losses | Land Use Summary | Instream Processes | Point Sources | Reservoirs | About



Average Curve Number: 77.68

Realistic hydrology is the foundation of any model. Pay particular attention to evapotranspiration, baseflow and surface runoff ratios. Baseflow/streamflow ratios for the US are provided by the USGS, these data are accessible via the button below. The ranges specified here are general guidelines only, and may not apply to your simulation area.

Show Avg. Monthly Basin Values | Show US Baseflow Map

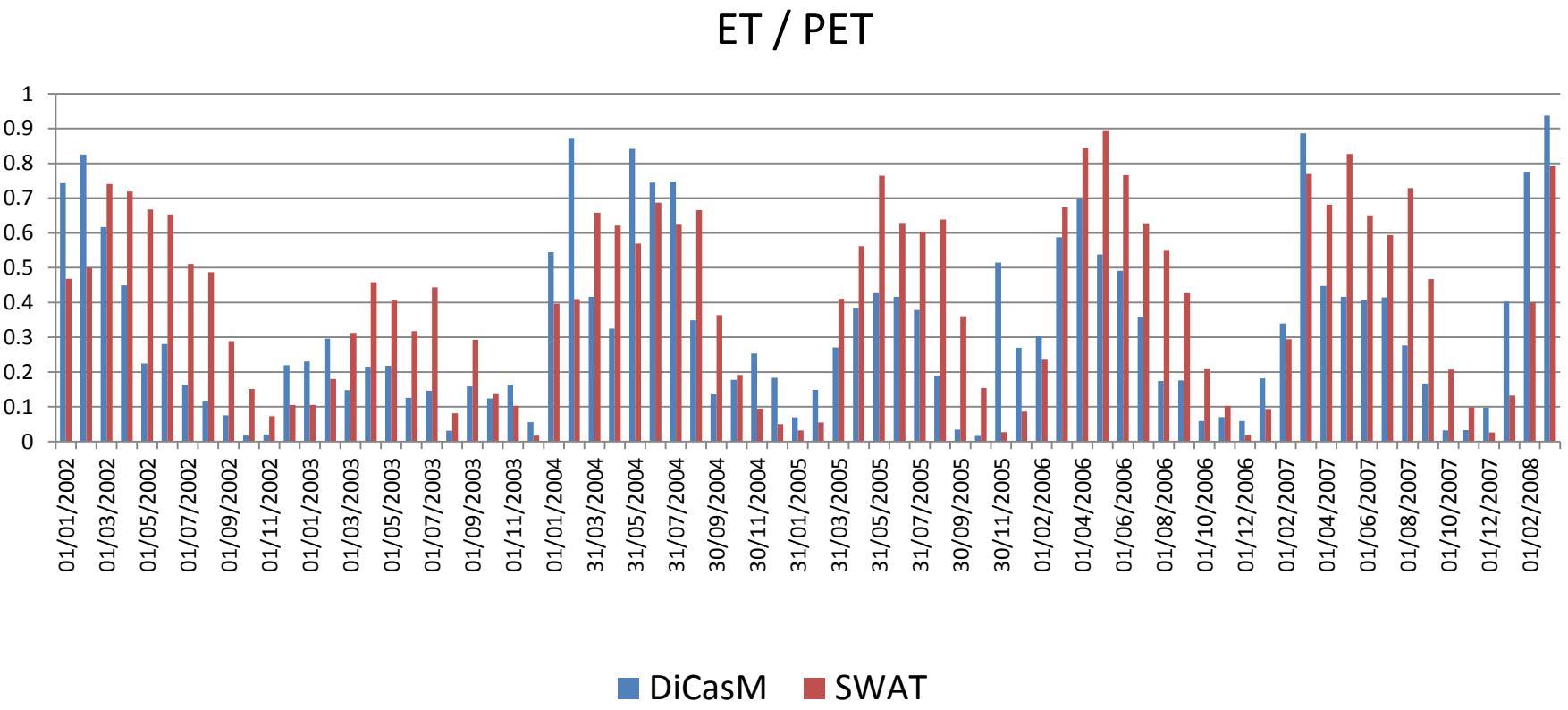
Messages and Warnings

Groundwater ratio may be low

Water Balance Ratios

Streamflow/Precip	0.23
Baseflow/Total Flow	0.26
Surface Runoff/Total Flow	0.74
Perc/Precip	0.08
Deep Recharge/Precip	0
ET/Precipitation	0.74

DiCasM – SWAT (ET / PET)



- DiCasM – (Montenegro & Ragab, 2010)

Conclusions

- SWAT simulations presented promissing results;
- Additional efforts are still required for calibration and validation ;
- Evapotranspiration is one of the key variable controls hydrologic processes in the basin.

- CNPq
- FINEP
- UFRPE

Thank you!

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