Hydrological impacts of forest conversion to grassland in small catchments in Brazilian Amazon

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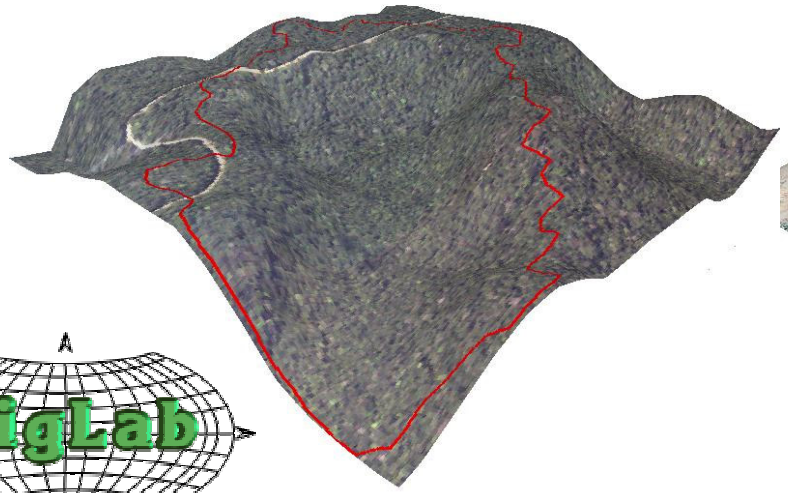
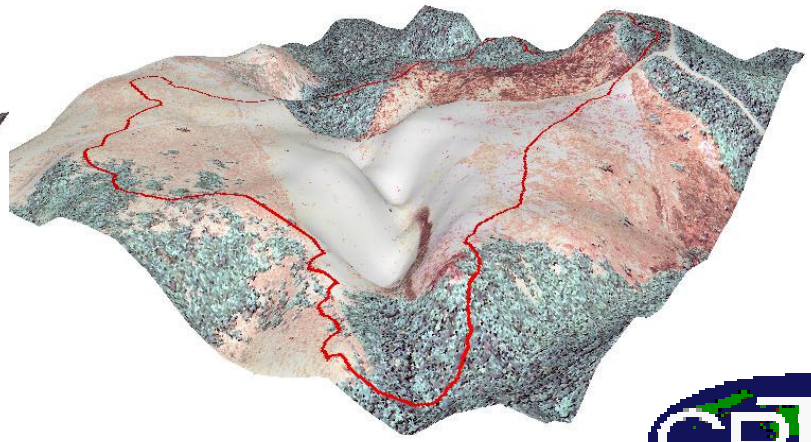
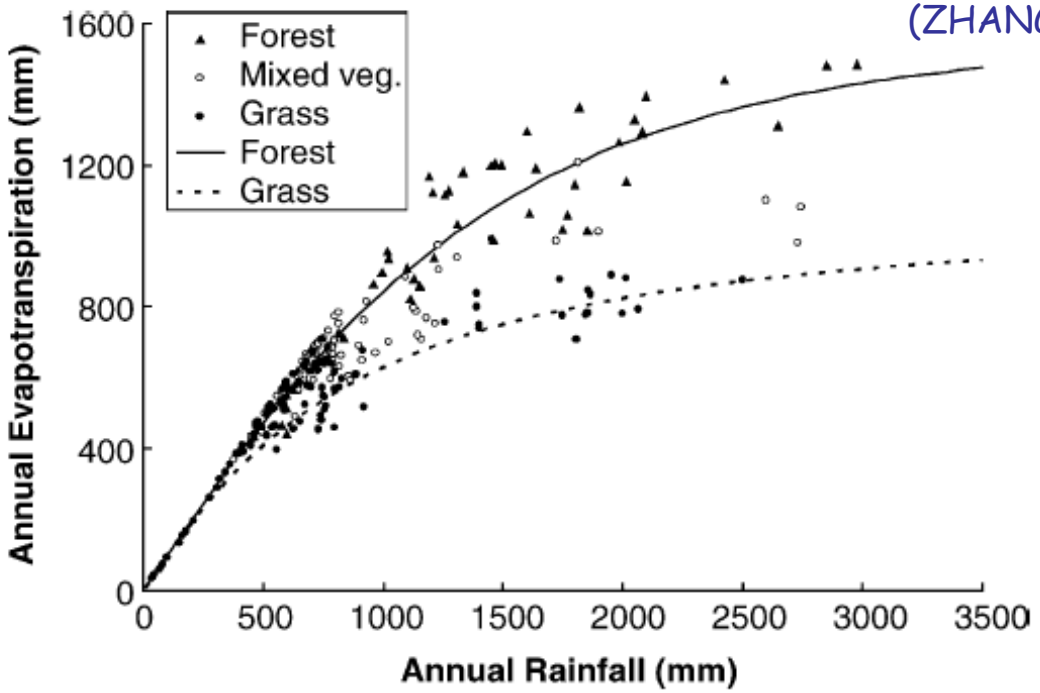


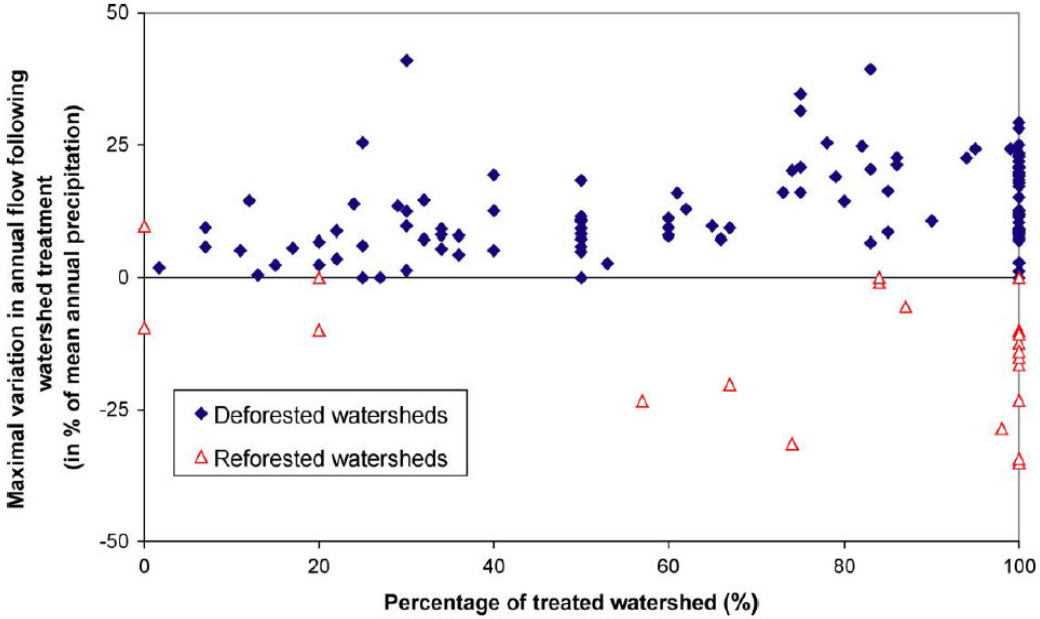


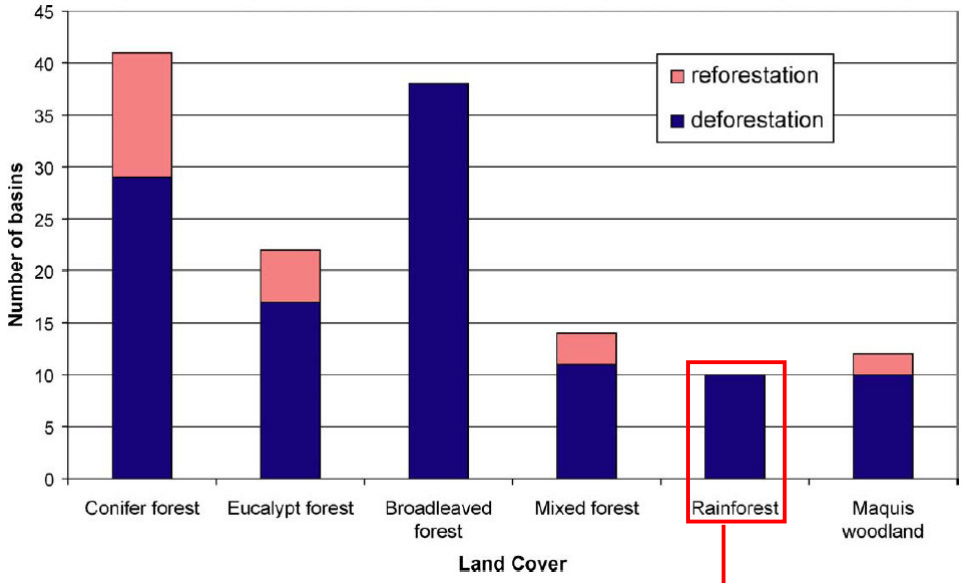
In general, it is accepted that changes on hydrological response are associated with equivalent changes in evapotranspiration.

(ZHANG et al., 2001)



Therefore, and since deforestation reduces the evaporation, it should produce an increase of water yield



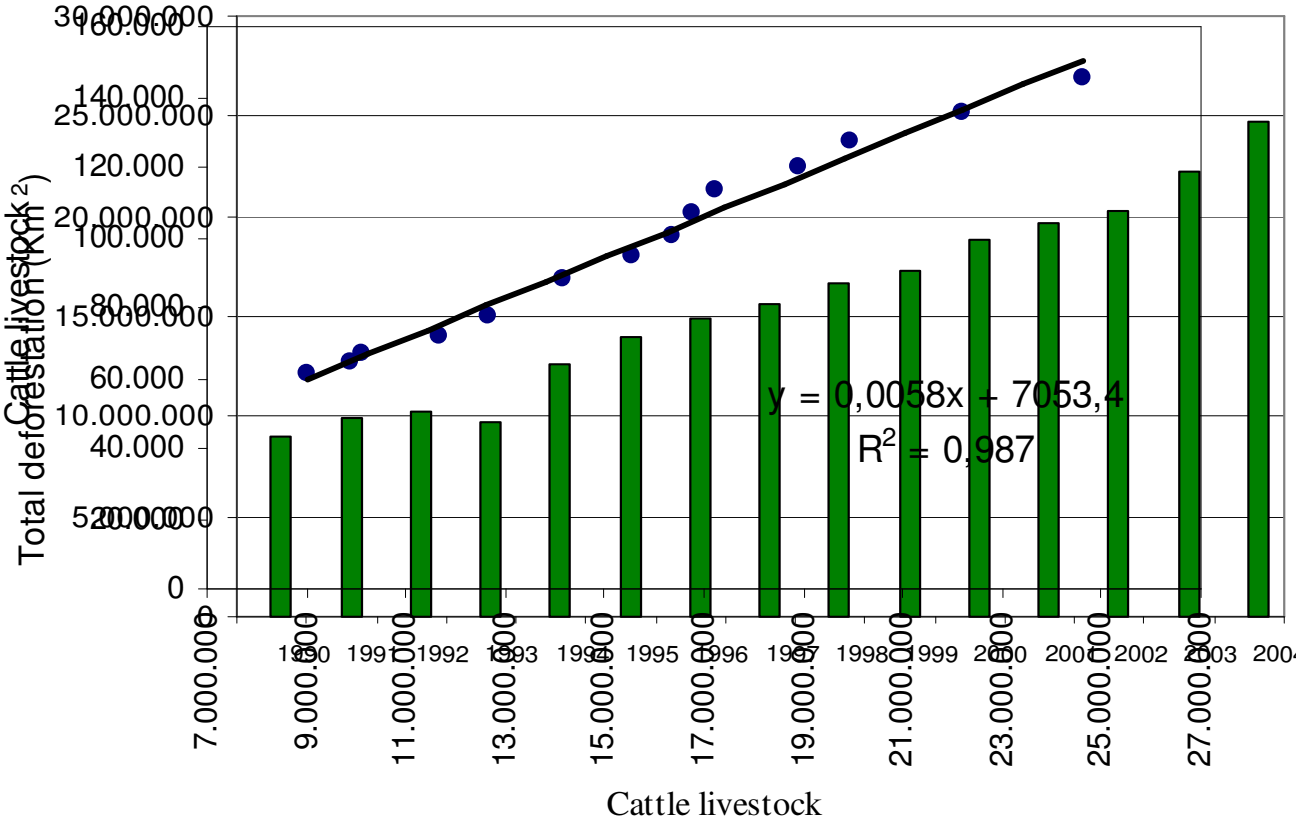


8 Guiana, 1 South Africa and 1 Austrália

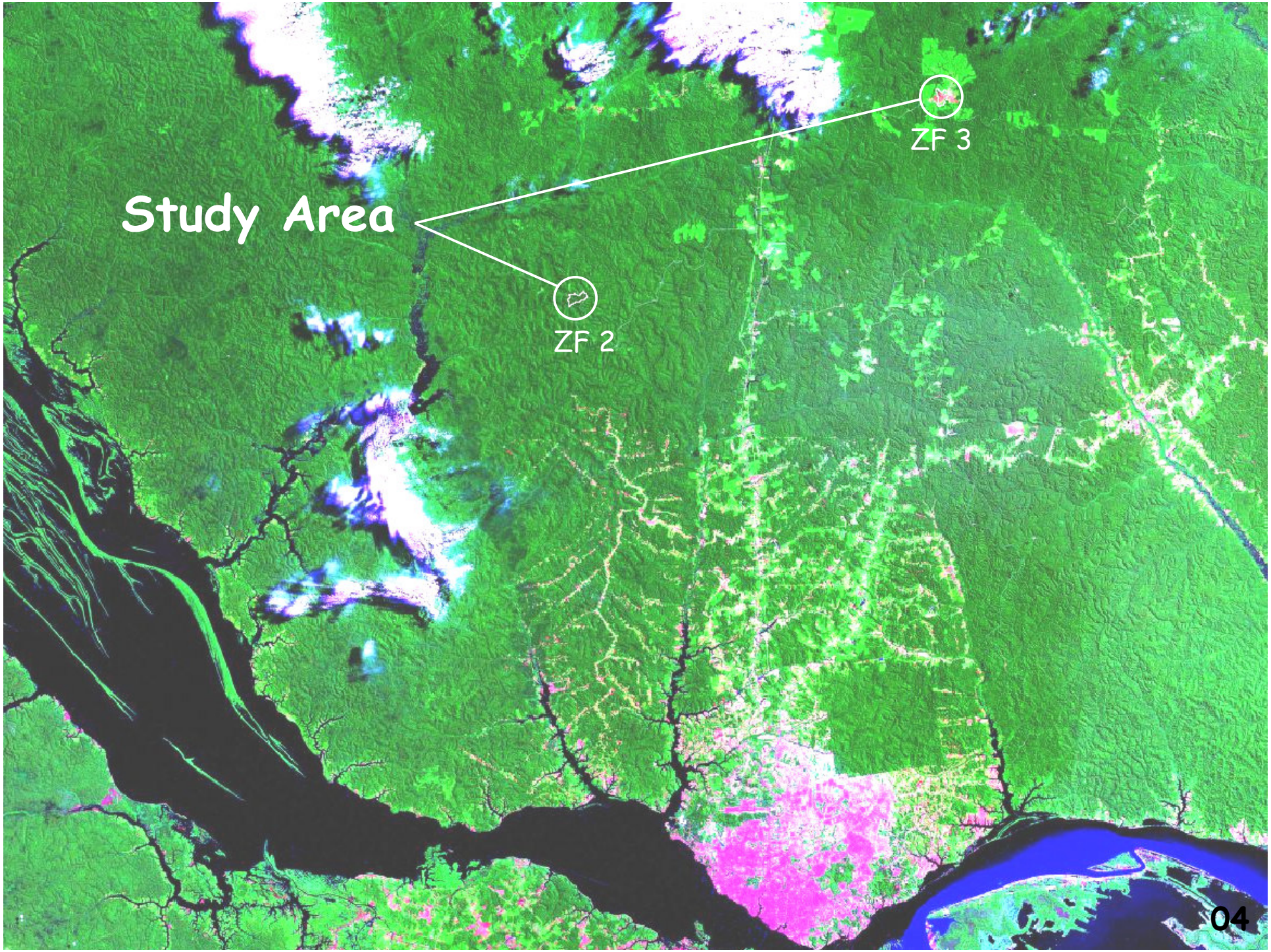
02 (ANDREASSIAN, 2004)

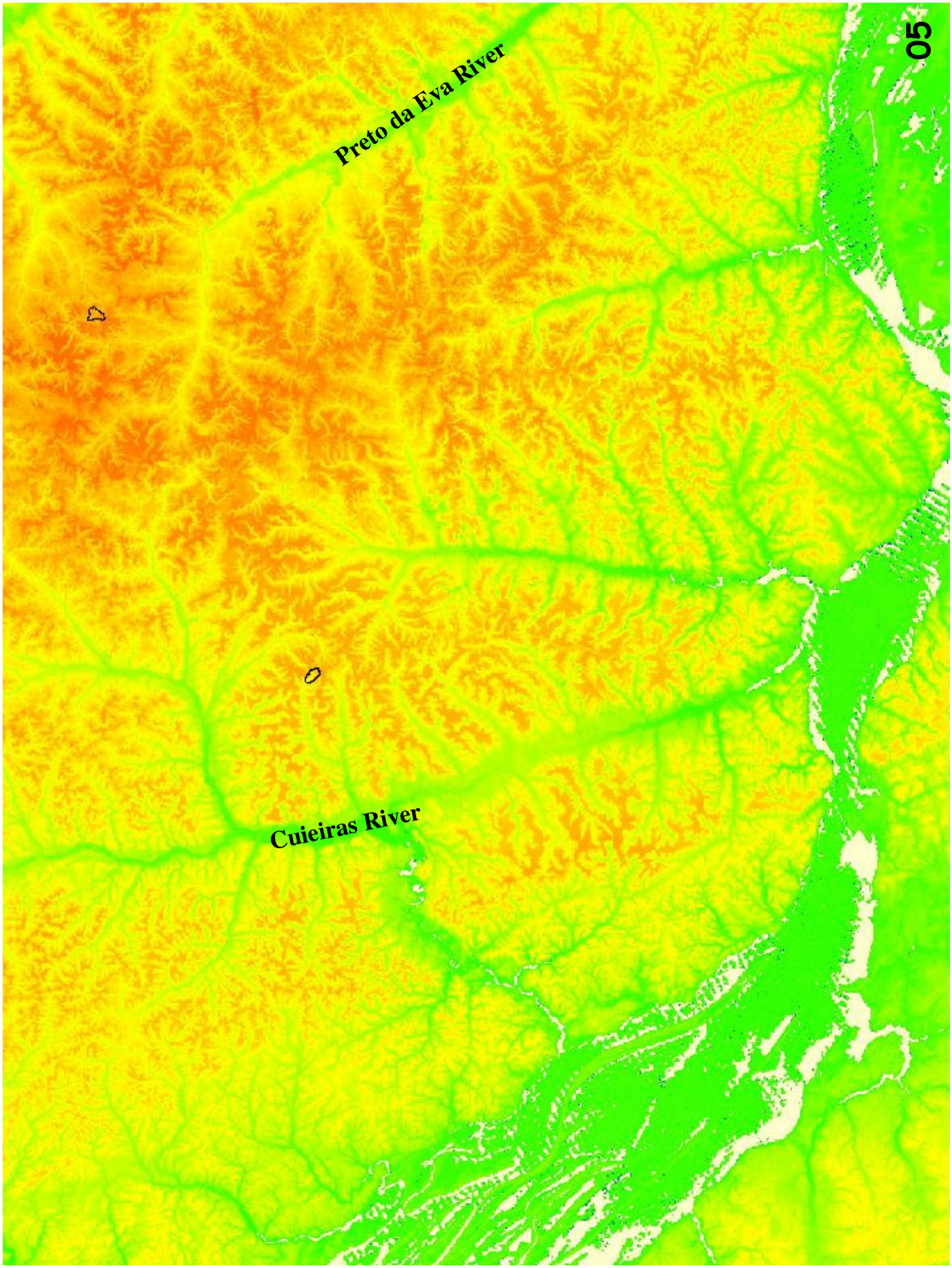
Pasture lands in Amazonia

- They cover about 80% of deforested lands

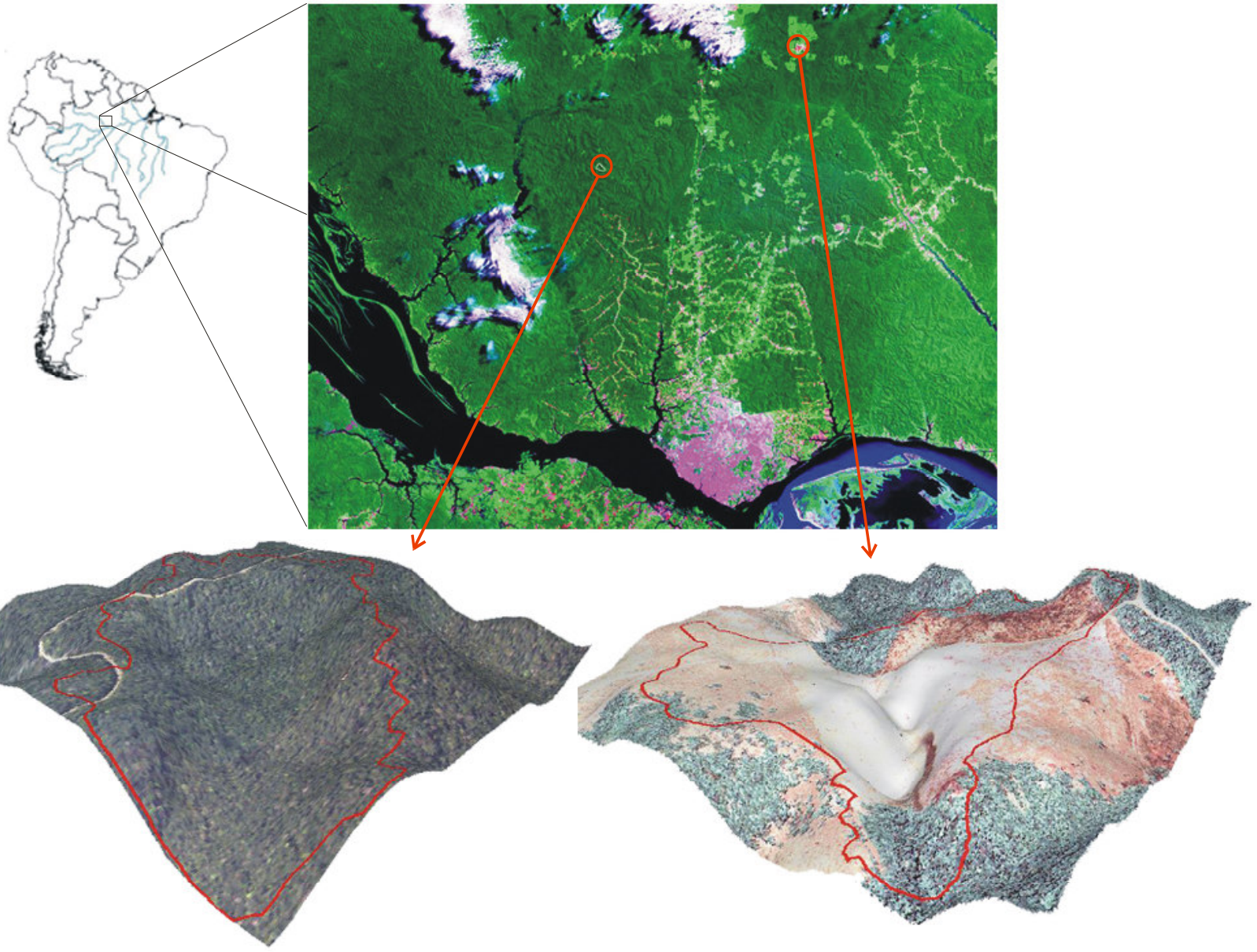


(MORAN, et al., 1994; FEARNSIDE, 1996, 1999; MARGULLIS et al., 2003; ASNER et al., 2004)


Study Area
ZF 3
ZF 2


Preto da Eva River
Cuieiras River
05

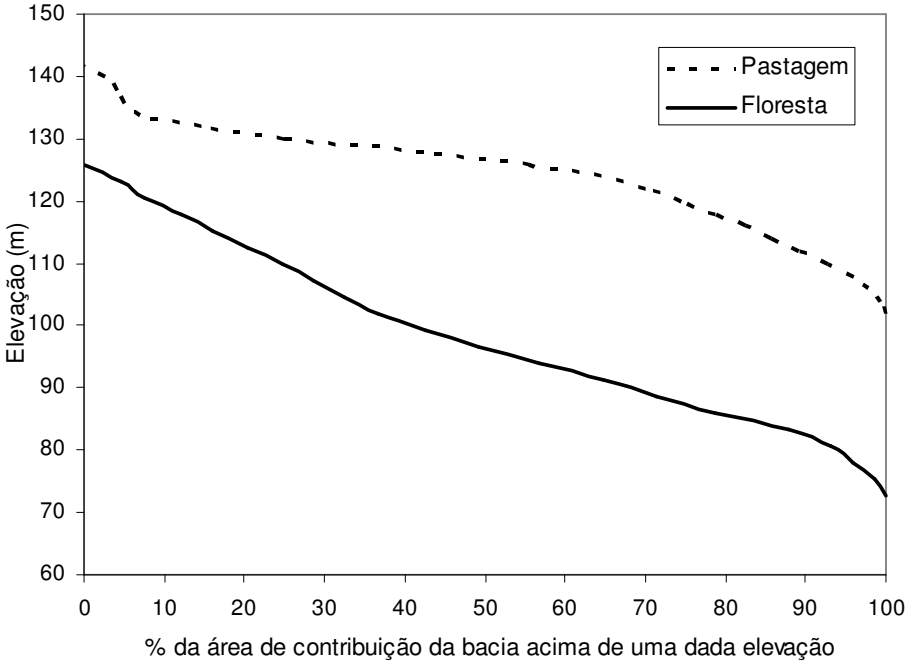
Study Area: two experimental catchments with forest and pasture (Drained area ~1.2 Km^2 for both catchments)

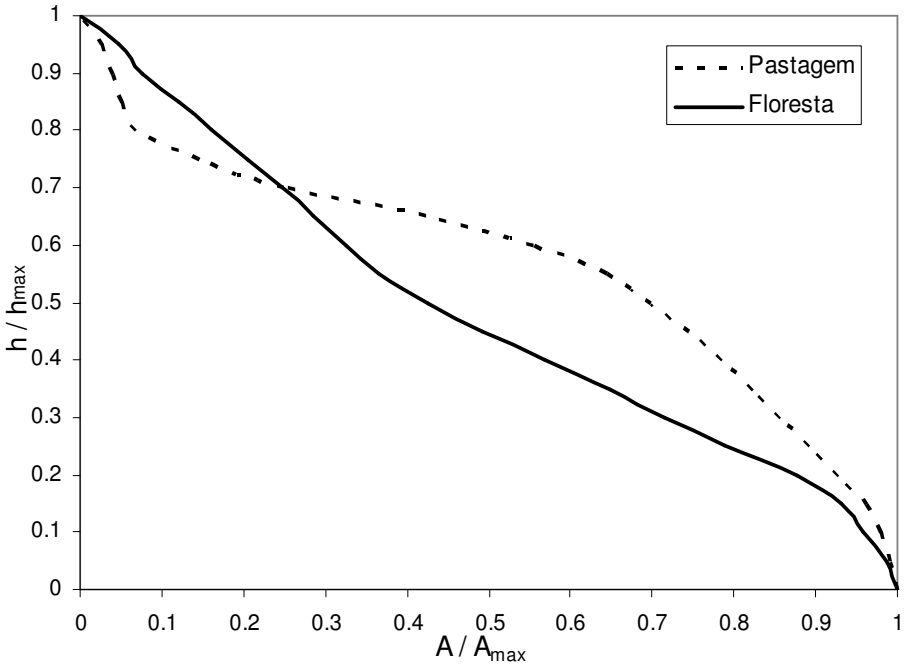


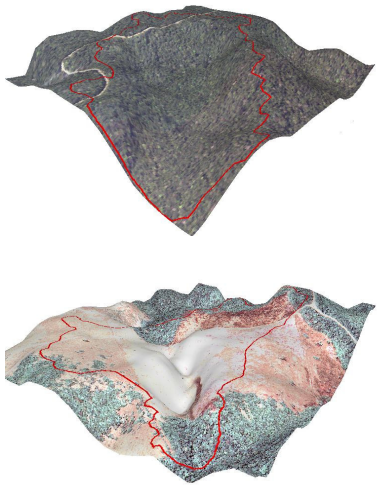
Catchments Instrumentation

Results

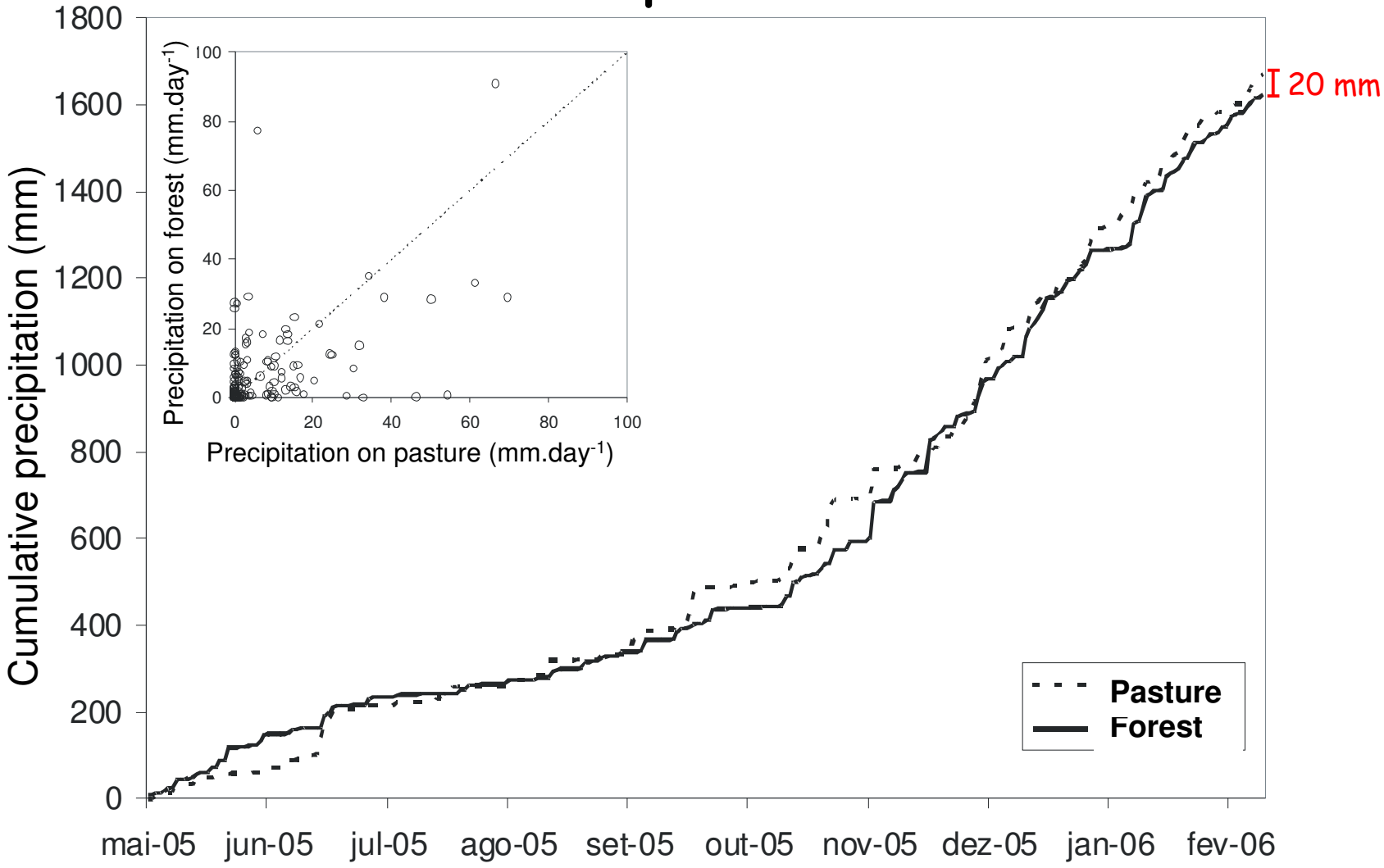
Topography

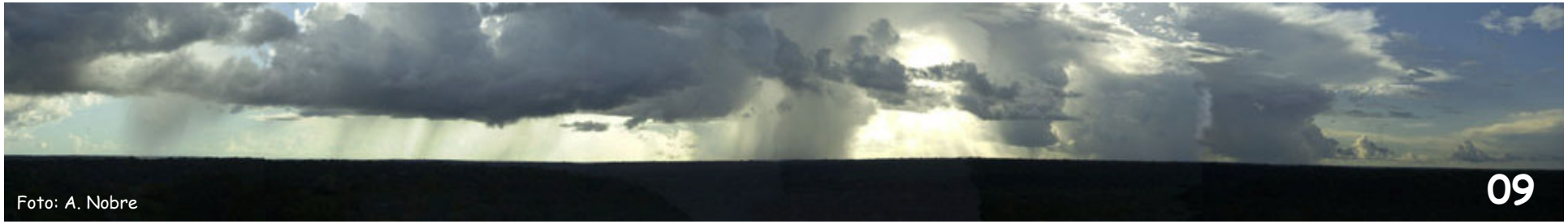




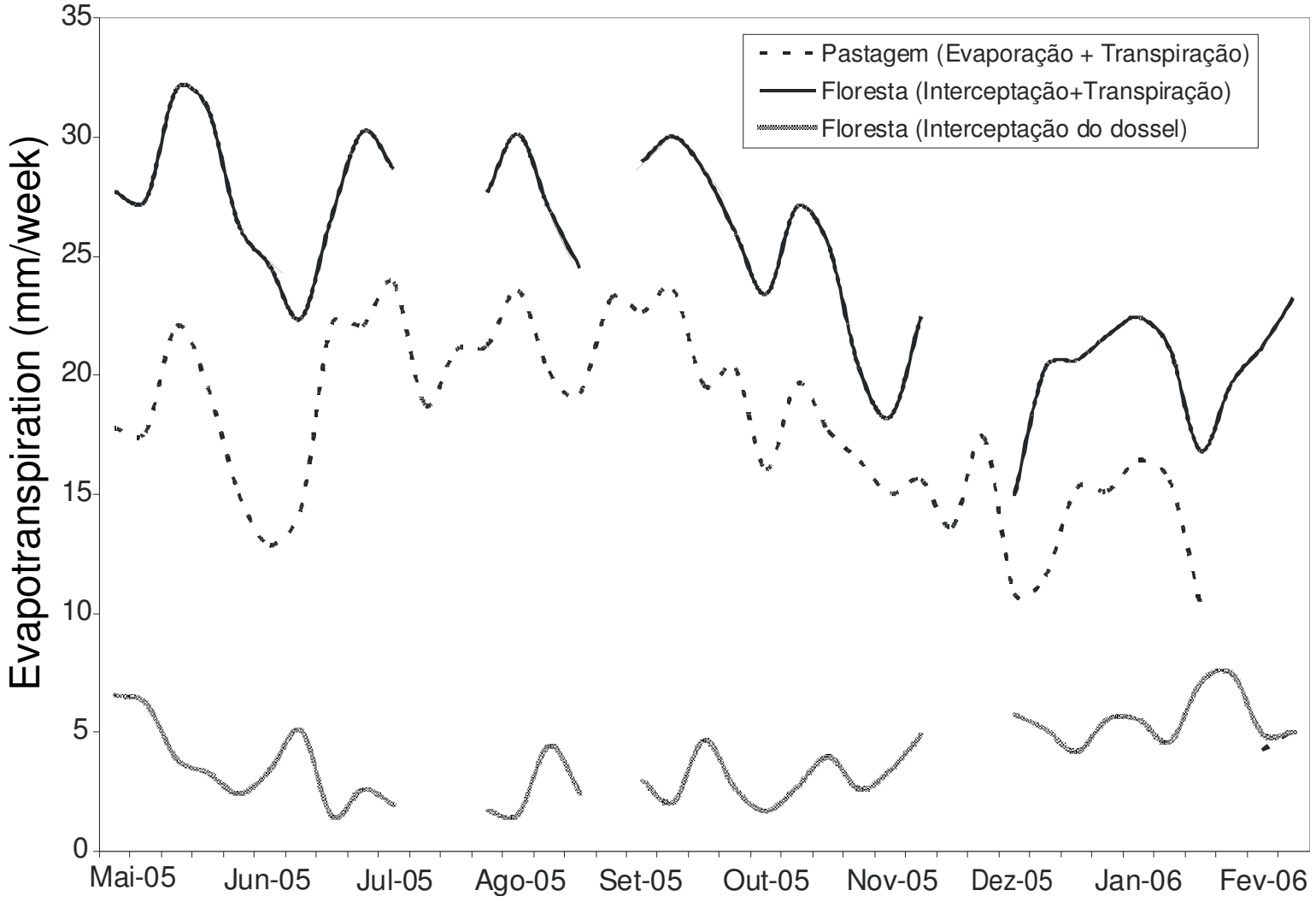


Precipitation



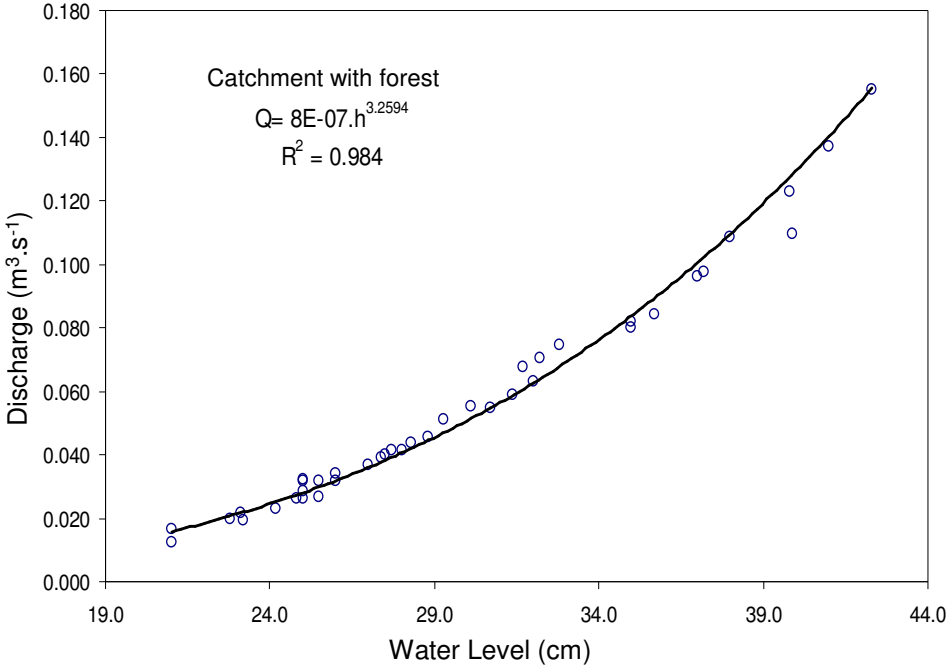


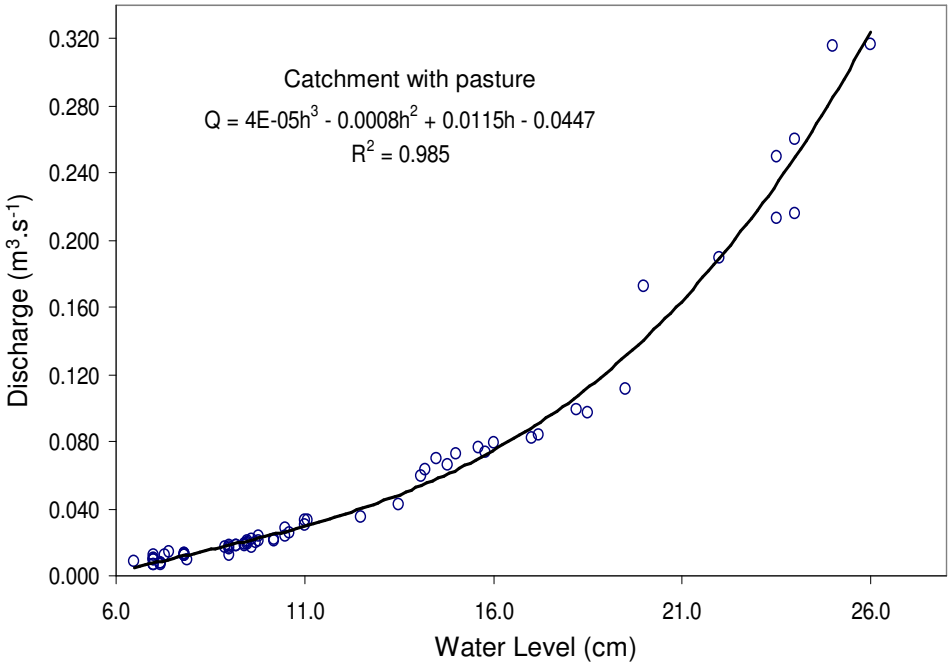
Evapotranspiration

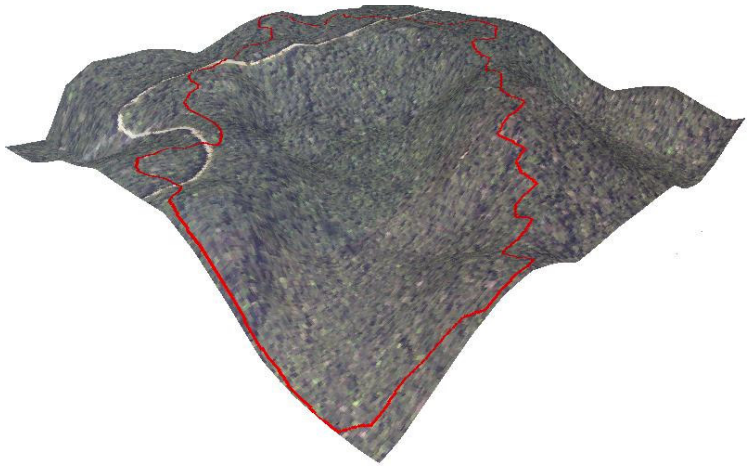


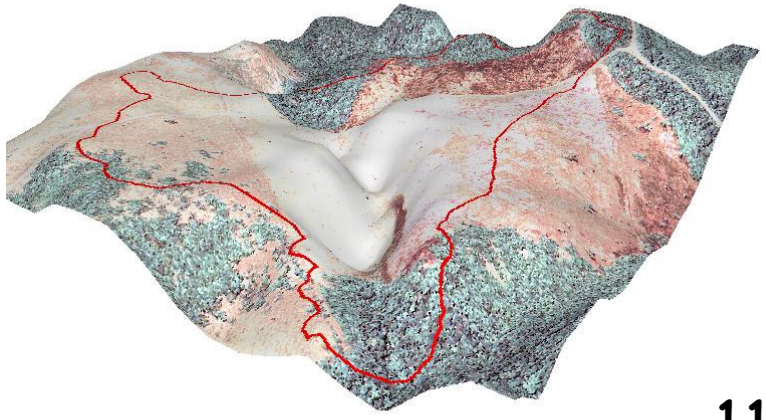
Discharge Curves

Mathematical models to convert water level (cm) to discharge ($m^3.s^{-1}$)



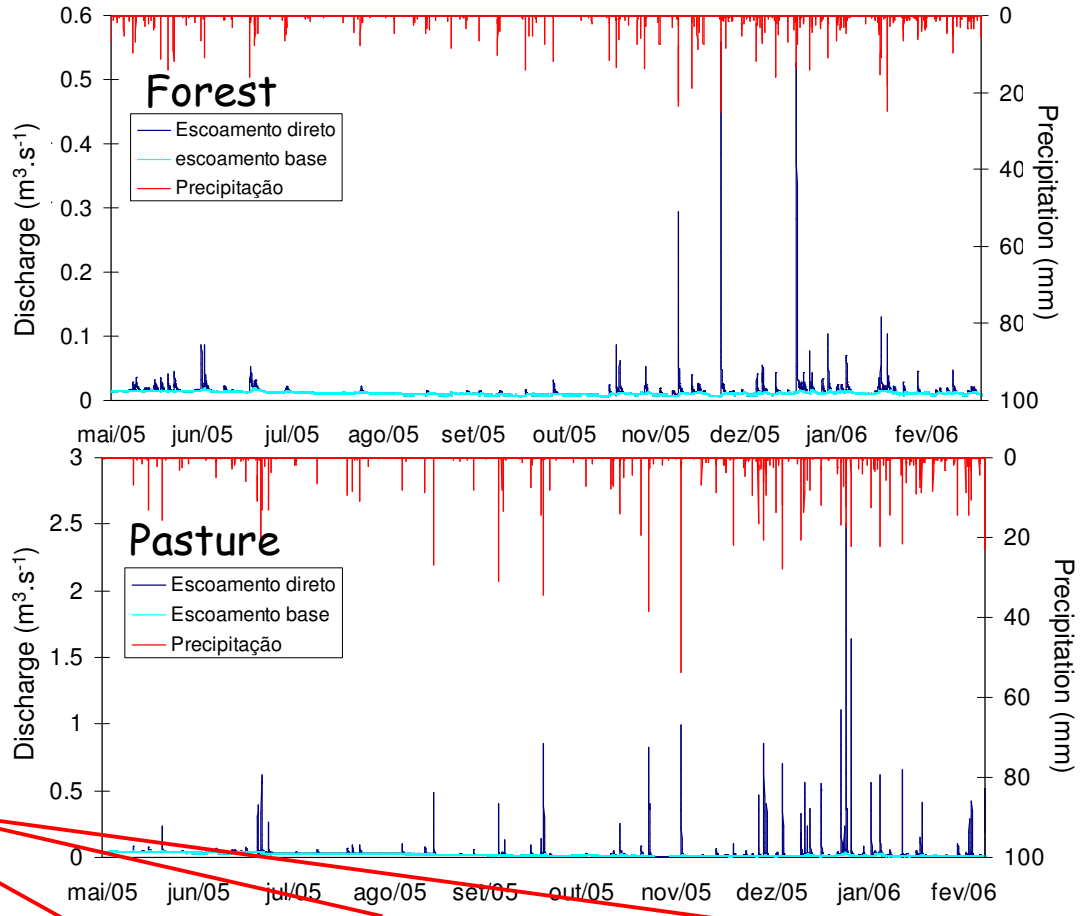






Discharge

Water yield in catchments with forest and pasture

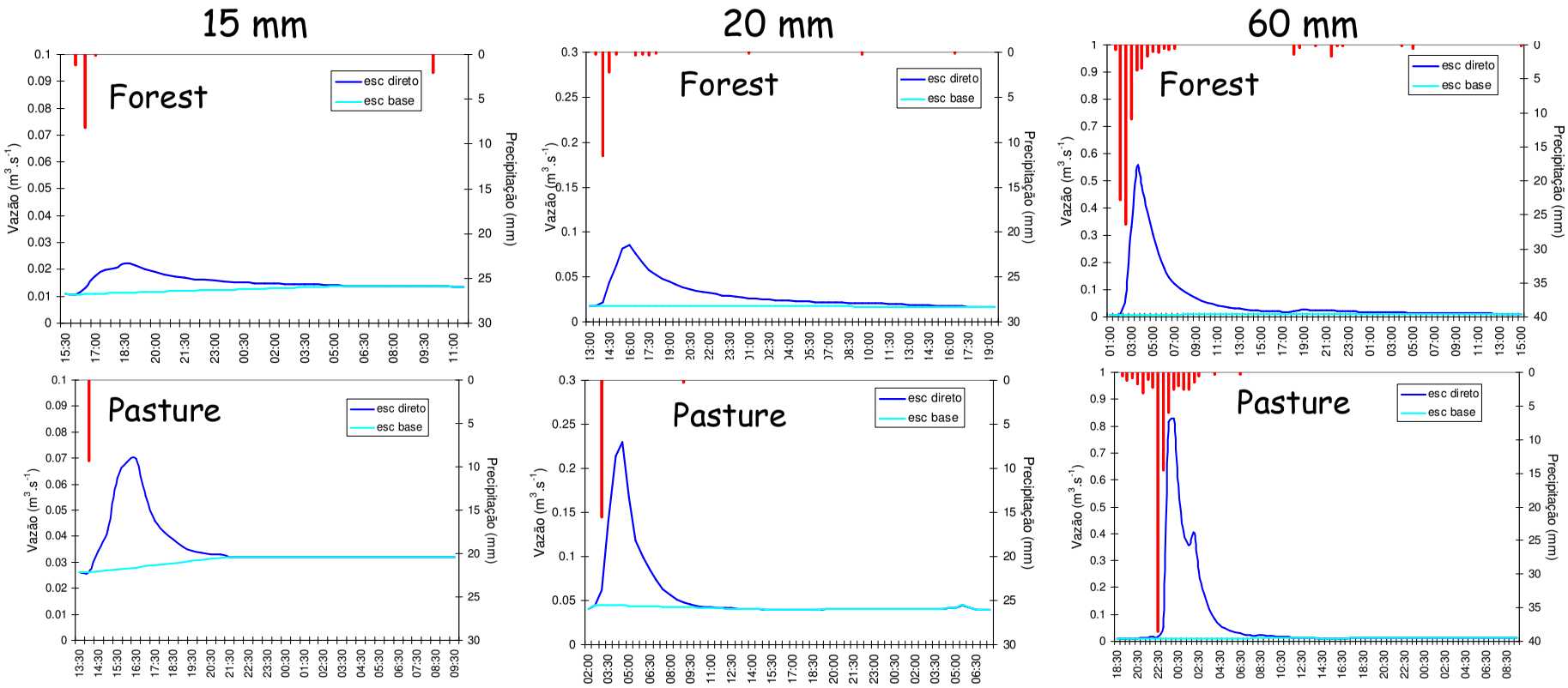


2 to 3 times higher

Land cover	Discharge (mm.day^{-1})	Base flow (mm.day^{-1})	Storm Flow (mm.day^{-1})	Base flow (%)	Storm Flow (%)
Pasture	1.888	1.388	0.500	73.53	26.47
Forest	0.902	0.764	0.138	84.72	15.28

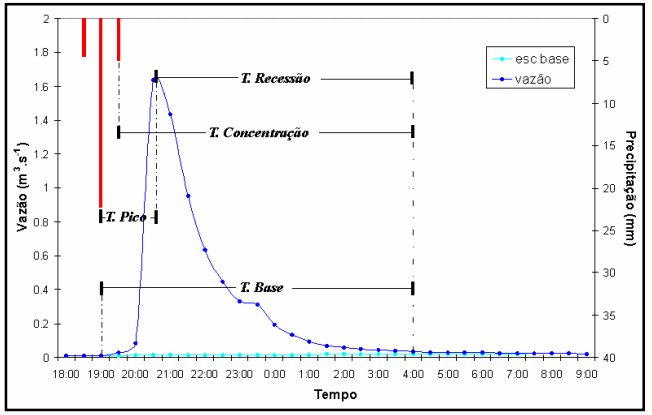
Evidences of runoff generation and erosion

Comparison of the hydrological response to equivalent rainfall

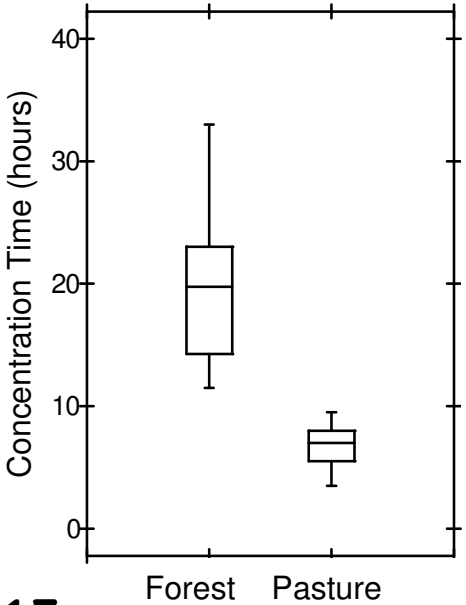


Discharge

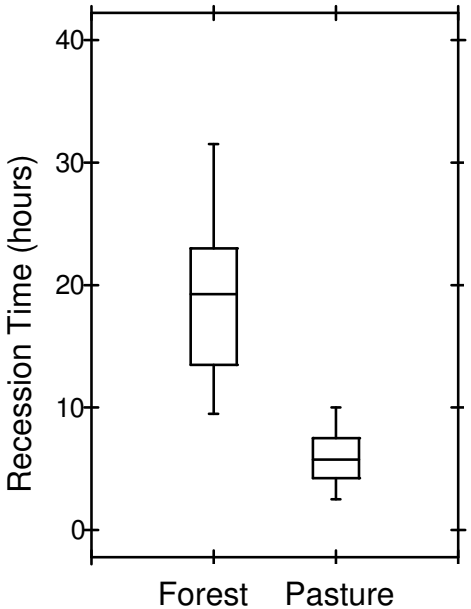
Speed response to precipitation



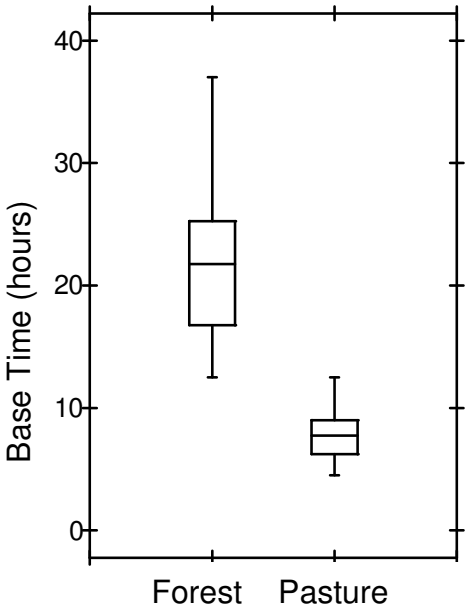
Land cover	Concentration Time	Recession Time	Base Time	Peak Time
Pasture	6.66 ± 1.46	5.90 ± 1.92	7.80 ± 1.83	2.53 ± 0.81
Forest	19.43 ± 5.31	18.60 ± 5.53	21.36 ± 5.54	3.24 ± 0.93



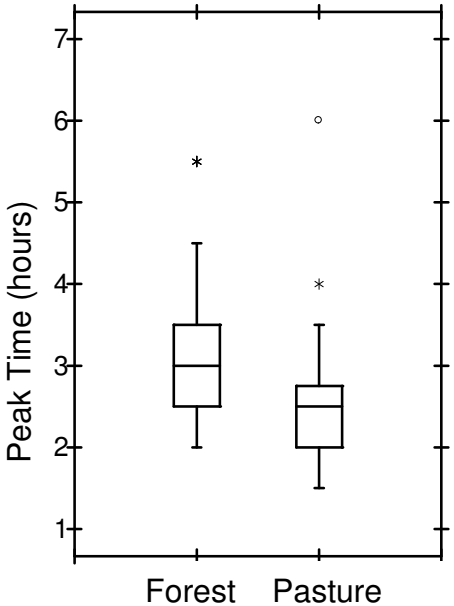
(F= 214.9; P<0.001; N=40)



(F= 188.4; P<0.001; N=40)

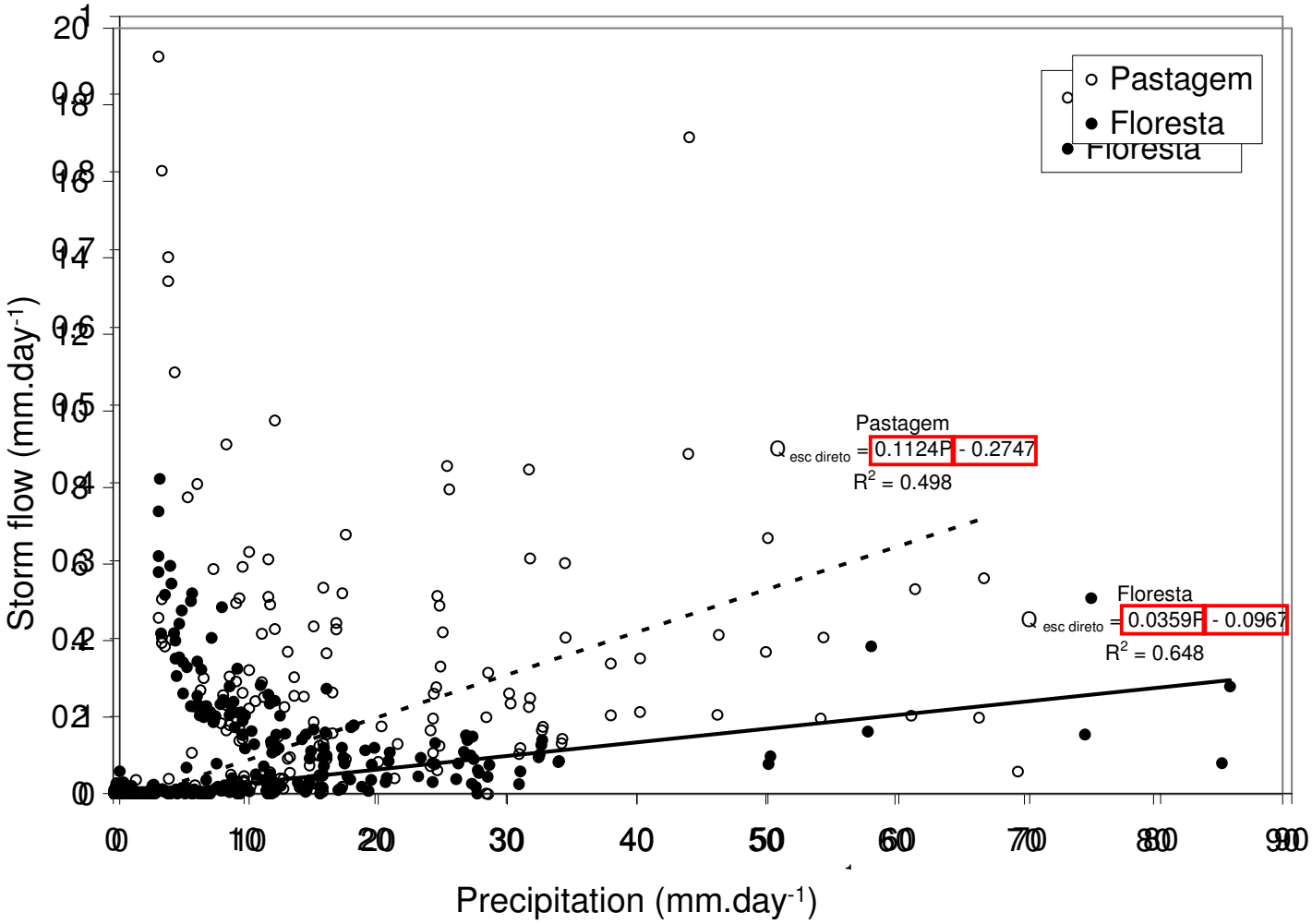


(F= 215.9; P<0.001; N=40)

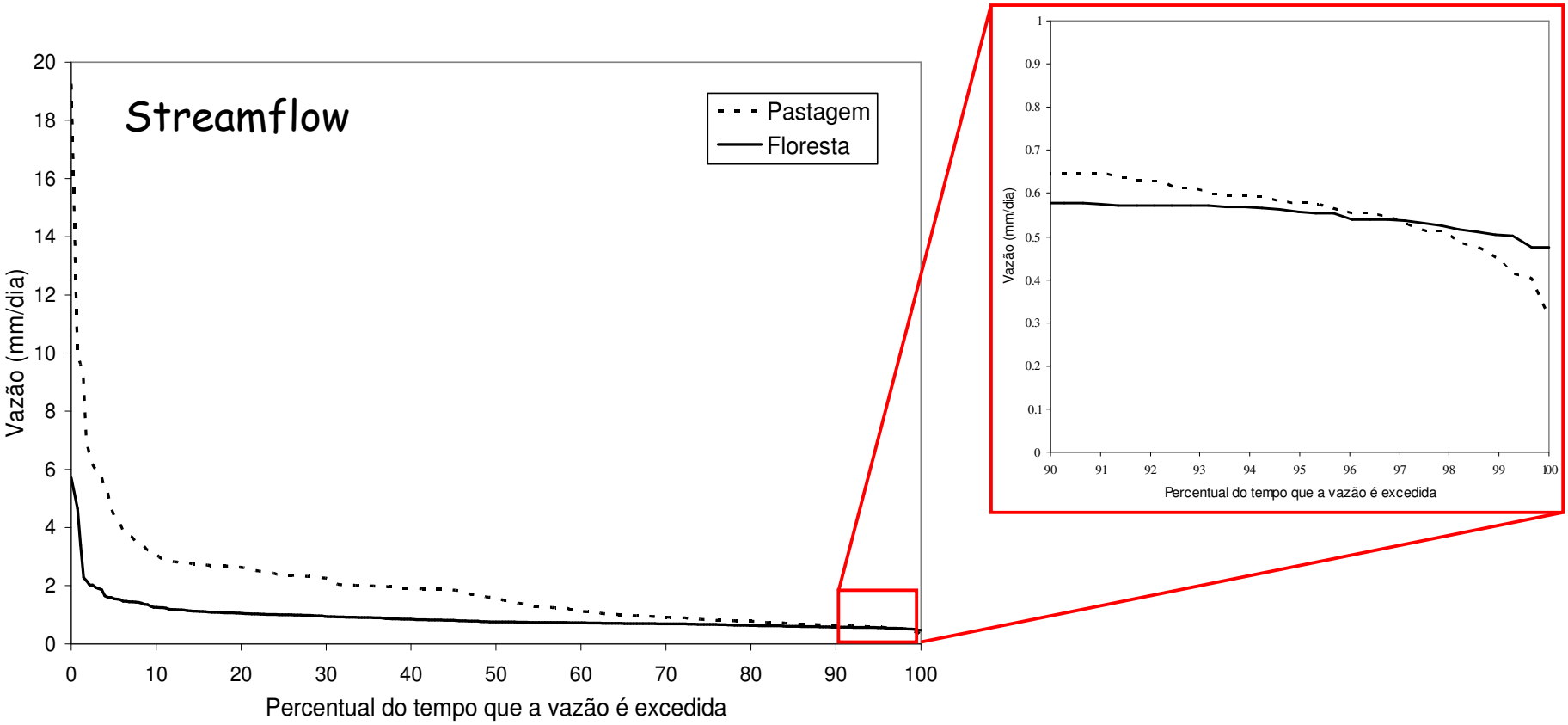


(F= 13.4; P<0.001; N=40)

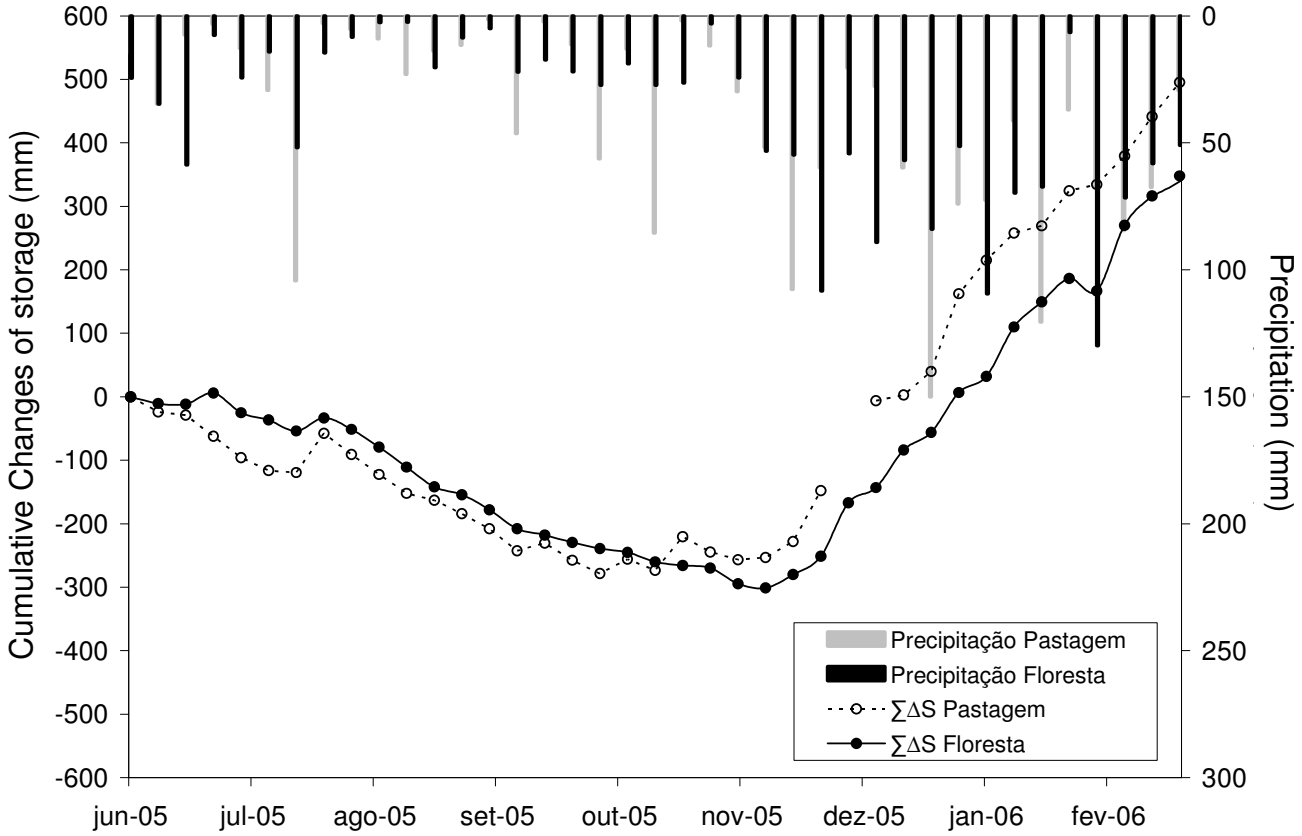
Relationship between precipitation and storm flow generation



Flow duration curves



Water Balance
Comparison of cumulative changes of storage



Land cover	Precipitation ($mm.day^{-1}$)	Discharge ($mm.day^{-1}$)	Evapotranspiration ($mm.day^{-1}$)	Changes of storage ($mm.day^{-1}$)	Runoff coefficient (Q/P)
Pasture	5.96	1.88	2.40	1.68	0.32
Forest	5.83	0.90	3.50	1.43	0.15

Conclusions

● Although the similarity on precipitation, significant differences were found on the other water balance components. Streamflow and water storage were respectively 0.98 $mm.day^{-1}$ e 0.25 $mm.day^{-1}$ higher in the pasture catchment than in the forest. The sum of these values is quite similar to evapotranspiration differences.

● Evapotranspiration average was 1.1 $mm.day^{-1}$ lesser in the pasture catchment than in the forest. 50% of this difference (0.54 $mm.day^{-1}$) is because of the canopy interception.

● Water yield was much higher on the pasture catchment due to changes on evapotranspiration. Discharge was 108% higher, Baseflow was 81% higher and stormflow was 262% higher on the pasture catchment

● Analysis of individual events have shown significant differences between forest and pasture in terms of the rainfall/runoff response. The speed response to precipitation in the pasture site is higher than in the forest site.

● Forest lose a great part of available water by evapotranpiration, and exerts an important ecological role in the water balance cycles. Observations suggest that conversion of forest to pasture might have significant impacts on the ability to regularize floods during the wet season and droughts in dry seasons on larger scales.

Acknowledgments

CAPES

Brazilian Component

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FINANCIADORA DE ESTUDOS E PROJETOS

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