Does secondary forest compensate the low evapotranspiration caused by conversion of forest to pasture?

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. Motivation

Conversion of forest to pasture leads to a decrease of evapotranspiration and consequently to a decrease in regional precipitation. This affects the climate of the region and even of other regions through transports and teleconections. This is the case of Amazonia, which exerts a key role on the humidity transport to the Southeastern region of Brazil.

Some studies have shown that the evaporative fraction increases with time in deforested areas that were abandoned allowing the secondary growth. This result brings up the following question:

Can changes in evapotranspiration rates related to deforestation be buffered by growth of secondary forest in Amazonia?

• Objective

• Identify the role of secondary forest on the hydrological cycle and compare with results of primary forest, evaluating the **evapotranspiration (ET), energy balance components and albedo**

. Main Conclusions

• Evaporative fraction at secondary forest (SF) is ~20% higher than at primary forest (PF) during the dry season

• Latent heat flux at SF is 20 to 40% higher than at PF during dry season and is similar or up to 10% higher than at PF during wet season

• Evapotranspiration at SF is 0.5 to 1.3 mm.day^{-1} higher than at PF during dry season

• Evapotranspiration at SF is on average 0.1 mm.day^{-1} lower or up to 0.4 mm.day^{-1} higher than at PF during wet season

• Evapotranspiration at SF has an important role in the compensation of the effects of deforestation in the hydrological cycle

. Sites and Data

• Two sites in Central Amazonia

- Primary forest (PF)

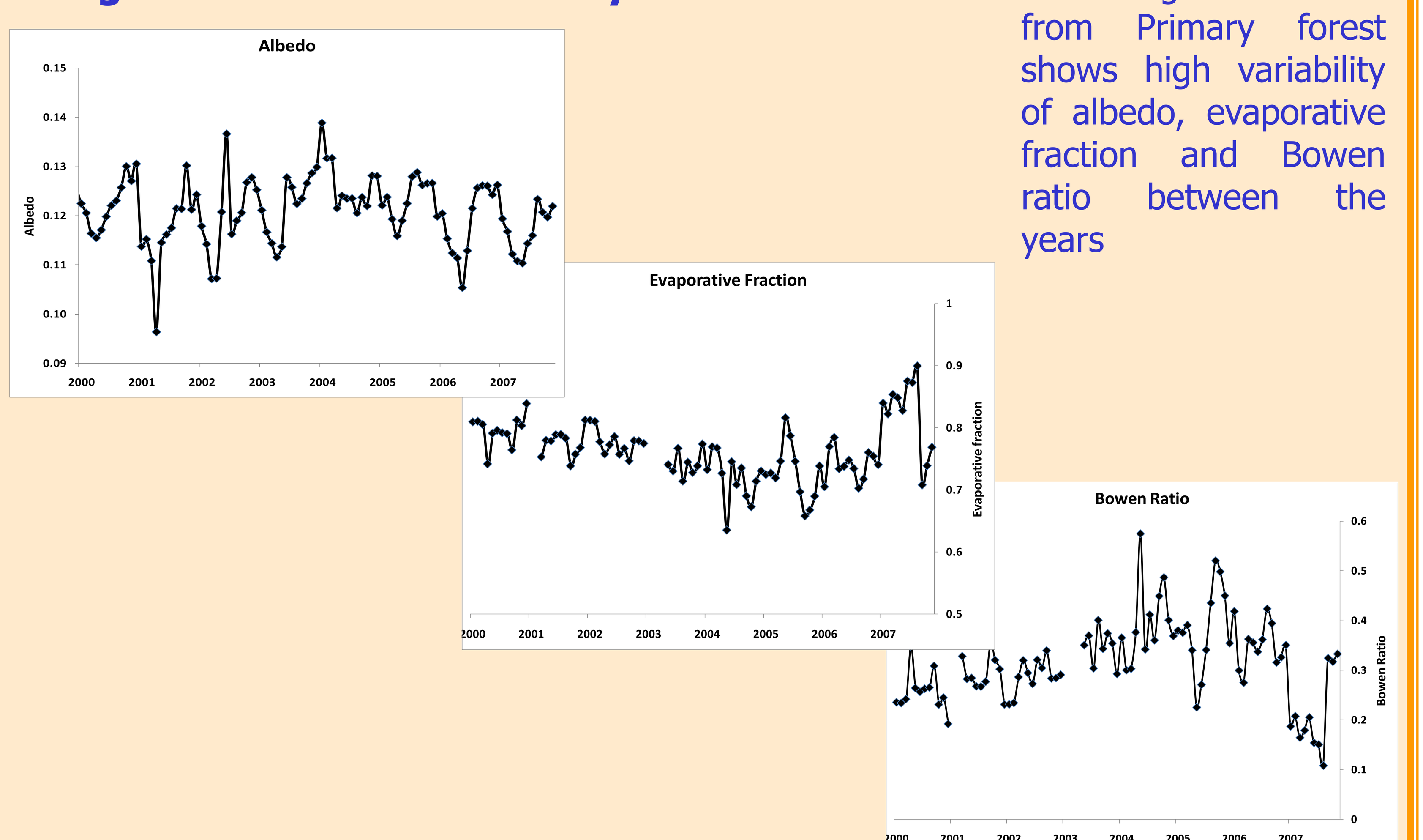
- Secondary forest (SF) resulting from abandoned pasture. The secondary forest's age range from > 21 years to younger

• Data from two flux towers

- Meteorological data

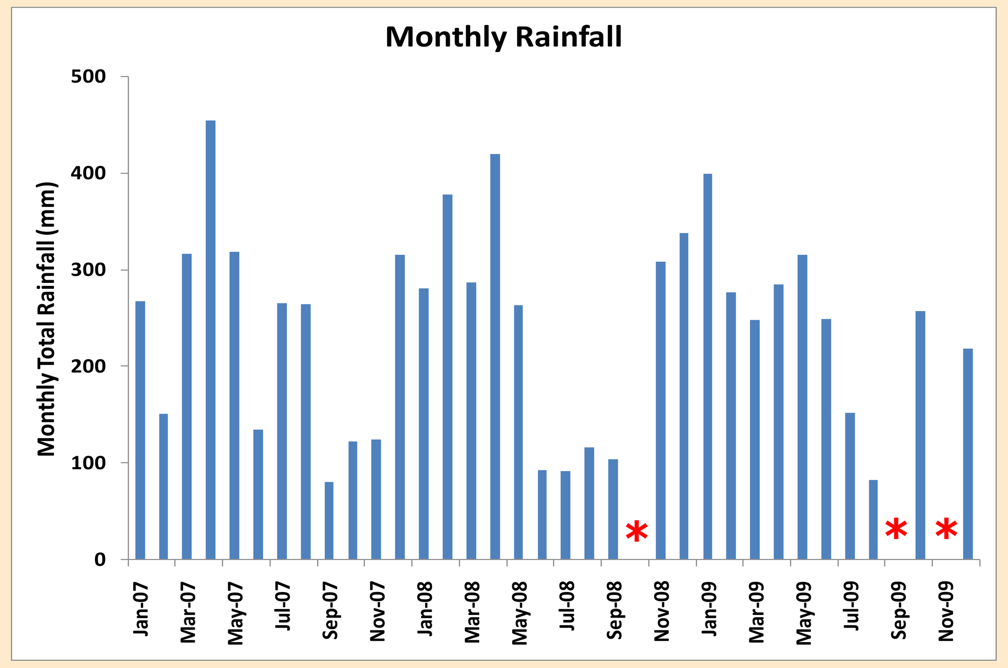
- Eddy flux

. Long term Data from Primary Forest



The long term data from Primary forest shows high variability of albedo, evaporative fraction and Bowen ratio between the years

. Results



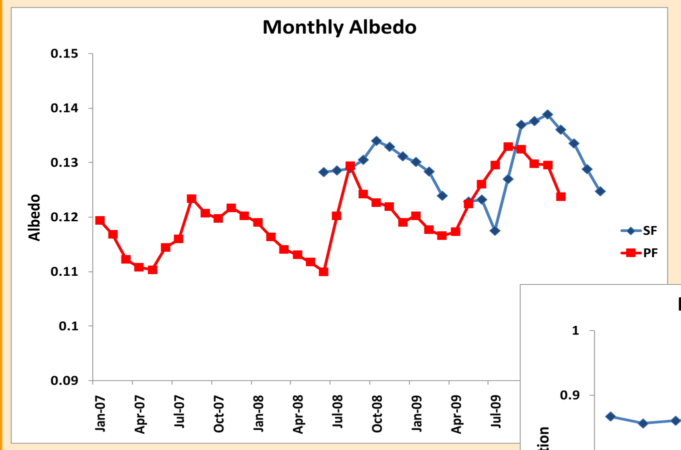
* Missing data

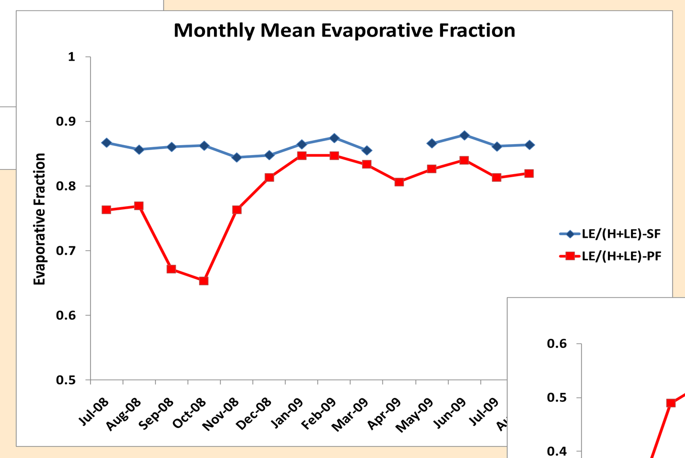
Rainfall

- Annual rainfall: ~ 2800 mm
- Dry season: June to October
- Wet season: November to May

Albedo (α)

- The α of SF < PF only during early dry season
- There is a delay in the seasonality on the α of SF in relation with the α of PF





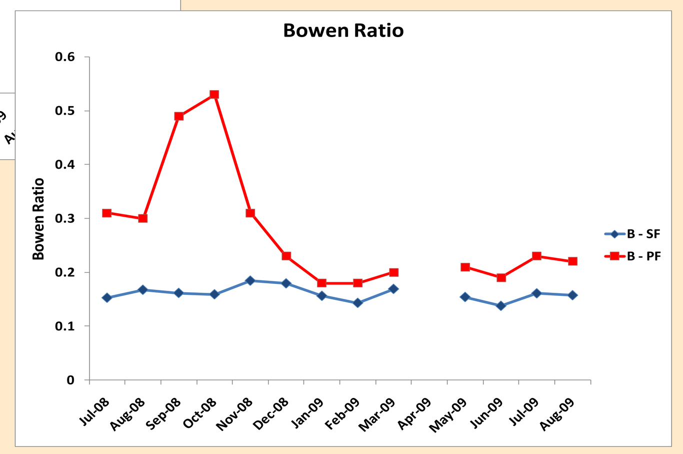
Evaporative fraction

- The evaporative fraction of PF presents a clear decrease during the dry season while in SF the evaporative fraction is more constant during the year

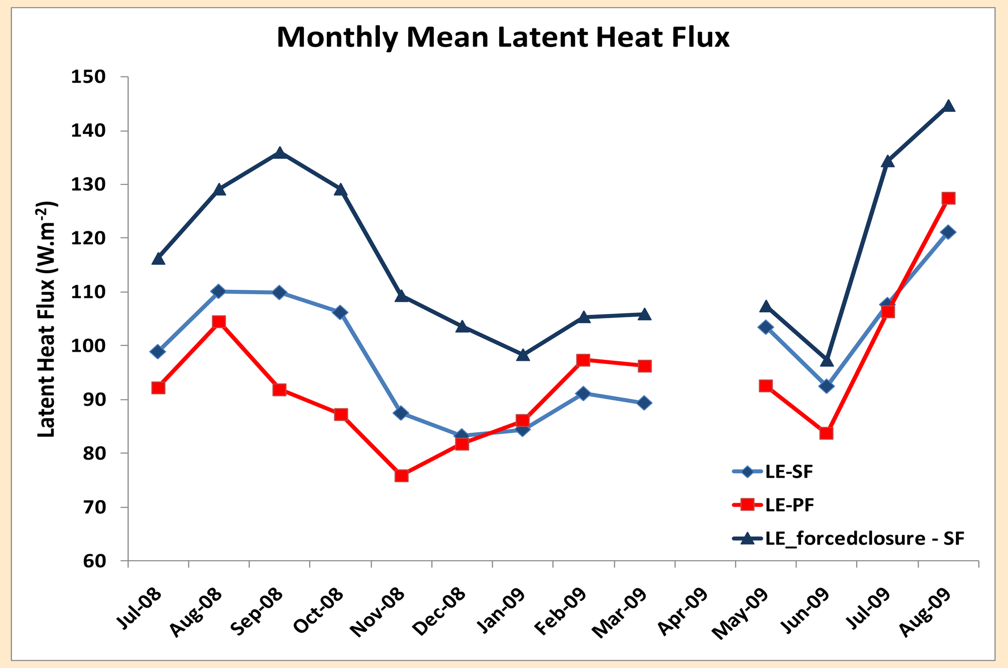
-The evaporative fraction in SF > PF

Bowen Ration (β)

- The energy available for sensible heat flux (H) at PF is higher than at SF
- β at PF has a peak during dry season, while at SF it is more constant



. Results



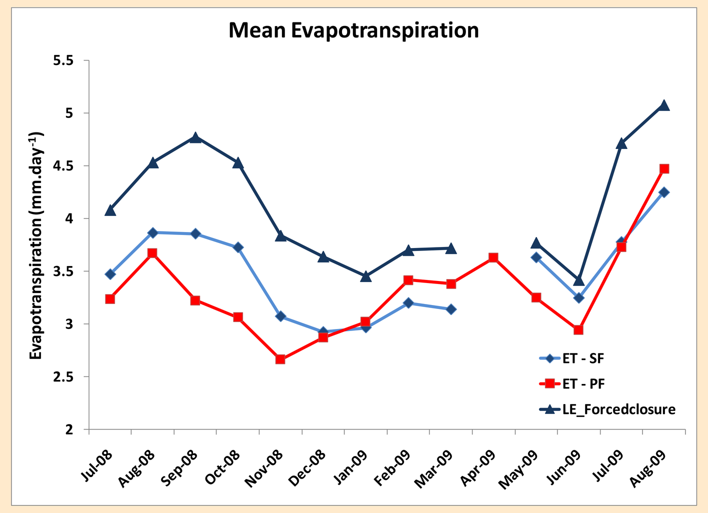
Latent Heat Flux (LE)

- LE at SF is higher than at PF during dry season
-LE corrected to force energy budget closure at SF is higher than at PF for the whole year

Obs: LE of primary forest is a result of forced energy budget closure

Net Radiation (Rn)

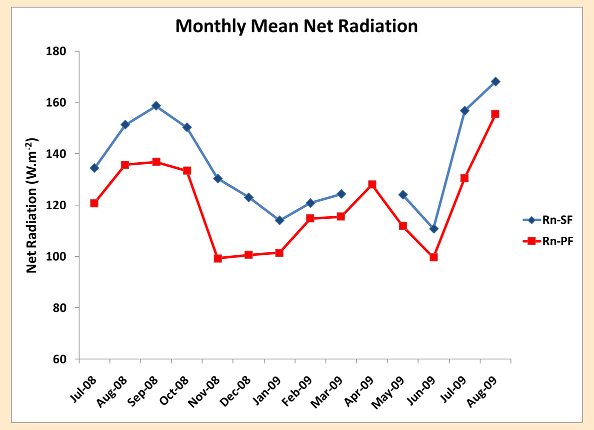
- Rn at SF is higher than at PF during the whole year



Evapotranspiration (ET)

- Measured ET at SF is up to 1.3 mm.day^{-1} higher than at PF
-It is likely that ET at SF is higher than at PF even if the Rn is overestimated, because:

1) ET at SF is already higher than at PF in considerable part of the year without any correction
2) ET at PF was already corrected to force energy budget closure , so it is higher than the measured ET



		LE (W.m^{-2})	H (W.m^{-2})	Rn (W.m^{-2})	LE/H+LE	E(mm.day^{-1})
	Dry Season					
	AUG-SEP-OCT					
2007	PF	116.3	28.6	144.9	0.8	4.1
2008	**PF**	**94.5**	**40.8**	**135.3**	**0.7**	**3.3**
2008	**SF ***	**108.7 to 131.4**	**22.1**	**153.5**	**0.9**	**3.8 to 4.6**
SF/PF		**1.2 to 1.4**	**0.5**	**1.1**	**1.2**	**1.2 to 1.4**
	Wet Season					
	JAN-FEB-MAR-APR-MAY					
2007	PF	110.7	20.9	131.6	0.8	3.9
2008	PF	83.3	21.8	105.1	0.8	2.9
2009	**PF**	**93.0**	**19.3**	**114.4**	**0.8**	**3.3**
2009	**SF ***	**92 to 104.3**	**16.6**	**120.8**	**0.9**	**3.2 to 3.7**
SF/PF		**1.0 to 1.1**	**0.9**	**1.1**	**1.0**	**1.0 to 1.1**

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