

Thematic Session

Orbital Monitoring of the Brazilian Pasturelands

Assessing **Degradation** and **Productivity** Levels



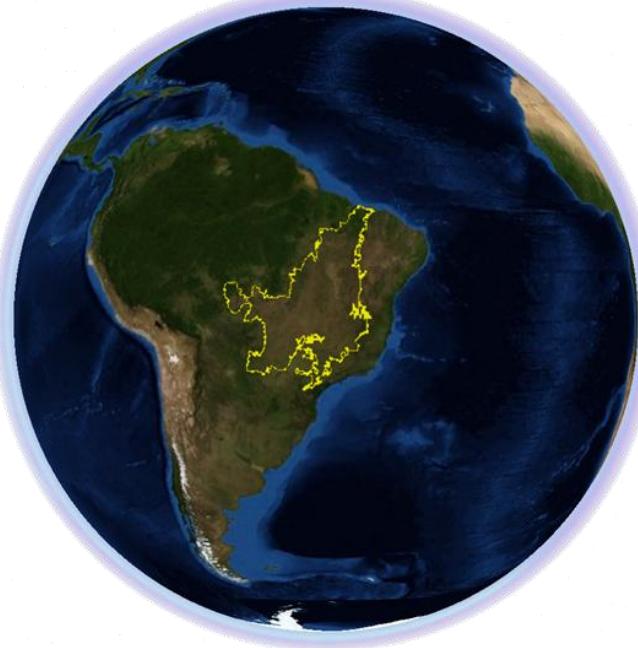
UFG

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Context

Premises

Σ EVI \cong Productivity



Context

Artigo da distribuição espacial-temporal das pastagens culturadas no Brasil

Revista IDEAS
Inovação em Desenvolvimento, Agricultura e Sociedade

Análise da distribuição espacial-temporal das pastagens culturadas no bioma Cerrado entre 1970 e 2008

Elaine Barboza
Laerte Gazzola Ferreira
Antônio Fernandes
Paulo Henrique Góes

Resumo
Em 2008, mais de 20% da fauna Cerrado eram usados como pastos diferentes padrões de distribuição espacial. Este artigo busca entender as pastagens culturadas do período de 1970 a 2008, com base no uso de satélites e técnicas de processamento de imagens. Os estudos descrevem características e classificações das pastagens. Verificou-se que a pastagem cultural aumentou até mesmo de céderas de 1985 até o começo de 1990 e que o uso se manteve relativamente constante.

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Revista Brasileira de Cartografia (2011) v. 63(1): 100-110
Revista Brasileira de Cartografia (2011) v. 63(1): 100-110

IDENTIFICAÇÃO DE CENÁRIOS ALTERNATIVOS PASTAGENS CULTIVADAS NO ESTADO DE GOIÁS: MODELO DE PROGRAMAÇÃO LINEAR
Identification of Alternative Scenarios for the Pasture Based on a Linear Programming Model

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ANÁLISE DA QUALIDADE DAS PASTAGENS CULTIVADAS NO CERRADO GOIANO A PARTIR DE IMAGENS VEGETAIS
Quality Assessment of Cultivated Pastures in MODIS Vegetation Index

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Resumo
Este artigo apresenta grande importância no contexto do Brasil, uma vez que descreve a identificação de cenários alternativos para a produção de pastagens cultivadas, com base em dados de campo e de satélite. O estudo demonstra a renda e custos de manutenção de um sistema de pastagens culturadas no Cerrado. As pastagens culturadas são uma forma de uso adequada, que pode ser utilizada para aumentar a produtividade e reduzir os custos de manutenção das pastagens naturais.

Palavras-chave: Pasturas, Pecuária, Produtividade.

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Revista Brasileira de Cartografia (2013) v. 65(1): 107-118

TRES_A_712223
Estudo da Qualidade das Pastagens Cultivadas no Cerrado Goiano a Partir de Imagens Satelitais

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Resumo
Este artigo descreve a análise da qualidade das pastagens culturadas no Cerrado Goiano a partir de imagens satelitais. O estudo demonstra a renda e custos de manutenção de um sistema de pastagens culturadas no Cerrado. As pastagens culturadas são uma forma de uso adequada, que pode ser utilizada para aumentar a produtividade e reduzir os custos de manutenção das pastagens naturais.

Palavras-chave: Pasturas, Pecuária, Produtividade.

Biophysical characteristics and fire occurrence of cultivated pastures in the Brazilian savanna observed by moderate resolution satellite data
Larissa G. Ferreira¹, Edilene E. Soárez², Luís E. Fernandes³, e Fabiano Soárez⁴
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Abstract
This article describes the analysis of cultivated pastures quality in the Goianian Cerrado using satellite data. The study demonstrates the income and maintenance costs of a system of cultivated pastures in the Cerrado. Cultivated pastures are a good way to increase productivity and reduce maintenance costs of natural pastures.

Keywords: Pastures, Agriculture, Productivity.

Biophysical Properties of Cultivated Pastures in the Brazilian Savanna Biome: An Analysis in the Spatial-Temporal Domains Based on Ground and Remotely Sensed Data
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Resumo
Este artigo descreve a análise das propriedades biofísicas das pastagens culturadas no Bioma Cerrado brasileiro usando dados terrestres e remotos. O estudo demonstra a renda e custos de manutenção de um sistema de pastagens culturadas no Cerrado. As pastagens culturadas são uma forma de uso adequada, que pode ser utilizada para aumentar a produtividade e reduzir os custos de manutenção das pastagens naturais.

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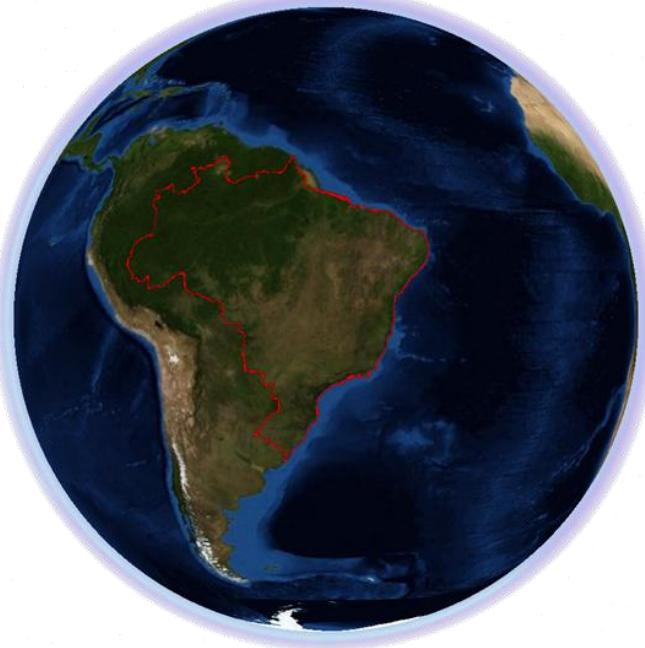
Abstract
Este artigo estimou, por vez primeira, a contribuição das pastagens culturadas no Brasil, focando-se no período de 2000 a 2008 e sua deforação resultante em pastoreio estabelecido e subseqüente queimação de pasto, e seu efeito sobre a emissão de gases de efeito estufa. O estudo considerou apenas o Amazonas e o Cerrado. Emissões de fermentação foram accounted for entire country. The difference between approximately 813 Mt CO₂eq in 2008 (annual mean) and 499 in 2003 (mean) Mt CO₂eq, that of the Cerrado from 229 to 233 country between 84 and 87 Mt CO₂eq. The full set of emissions responsible for approximately half of all Brazilian emission Mt CO₂eq in 2008, even without considering cattle related study, such as energy use for transport and refrigeration a chain. The potential for reduction of greenhouse gas emissions

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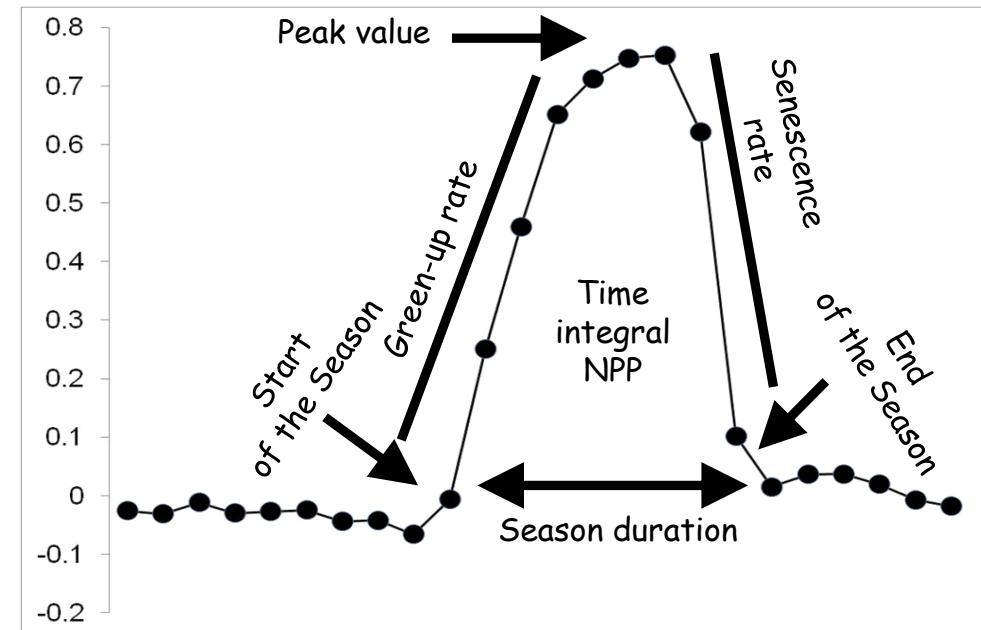
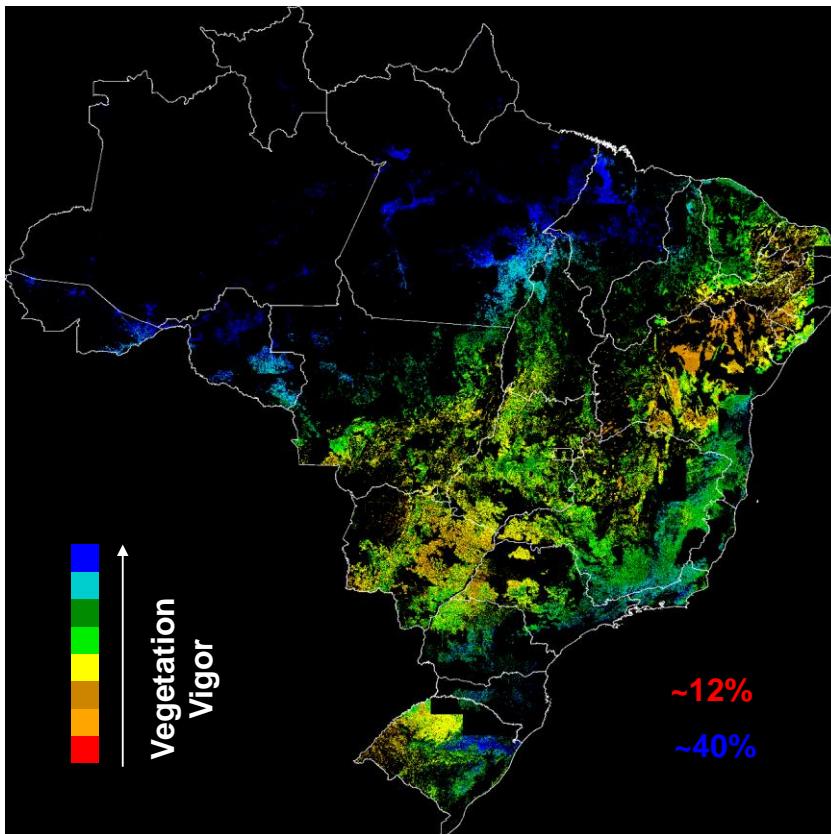
Premisses

$$\Sigma \text{EVI} \cong \text{Productivity}$$



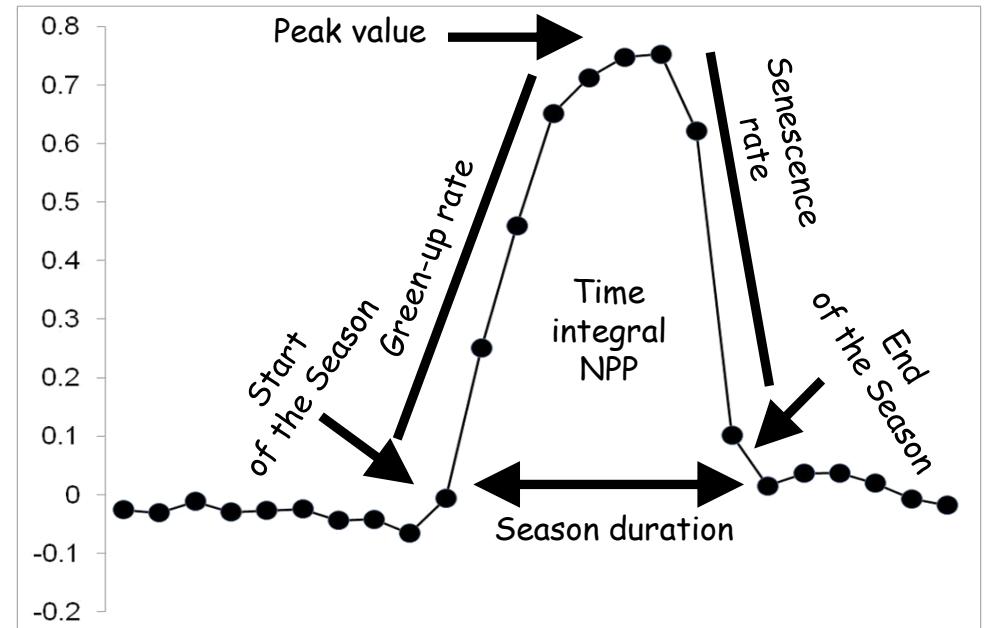
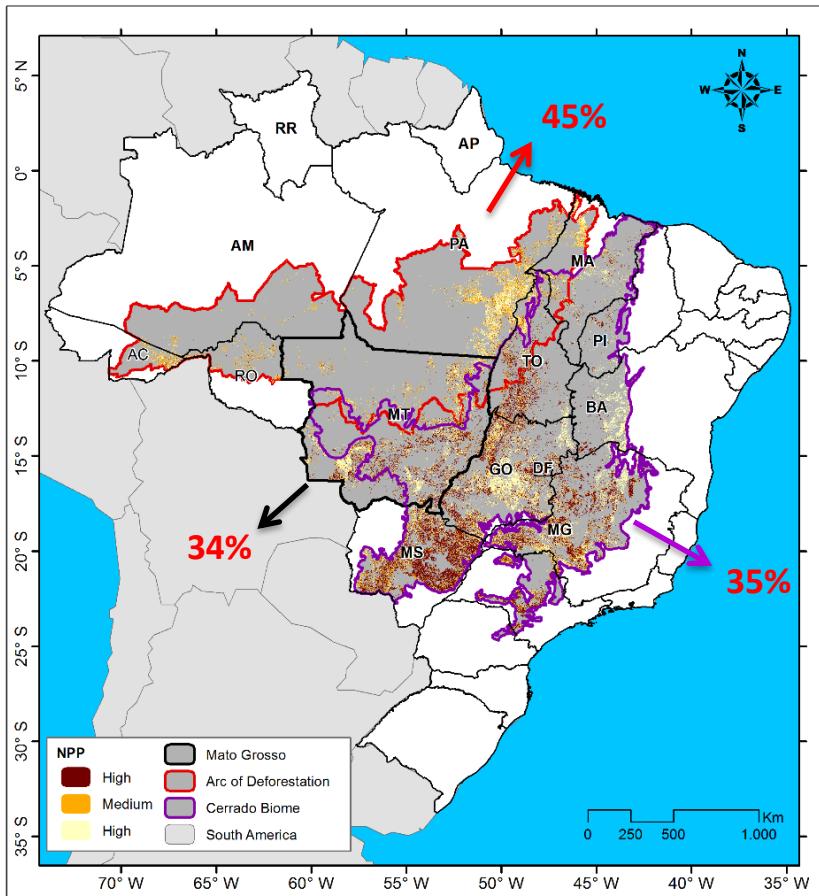
Seasonal Metrics: Vegetation Vigor

ETn – Normalized Evapotranspiration



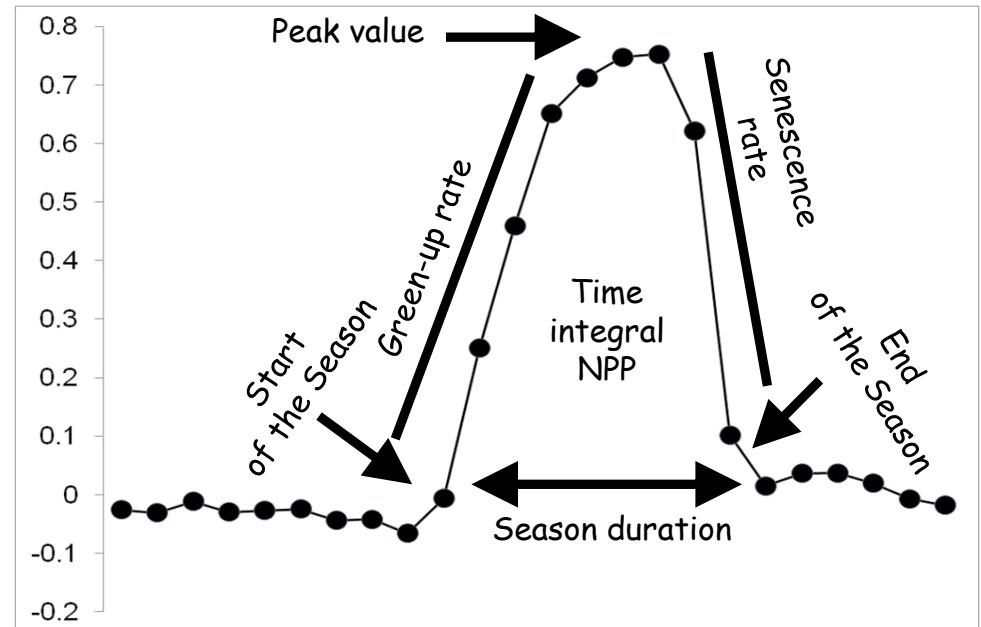
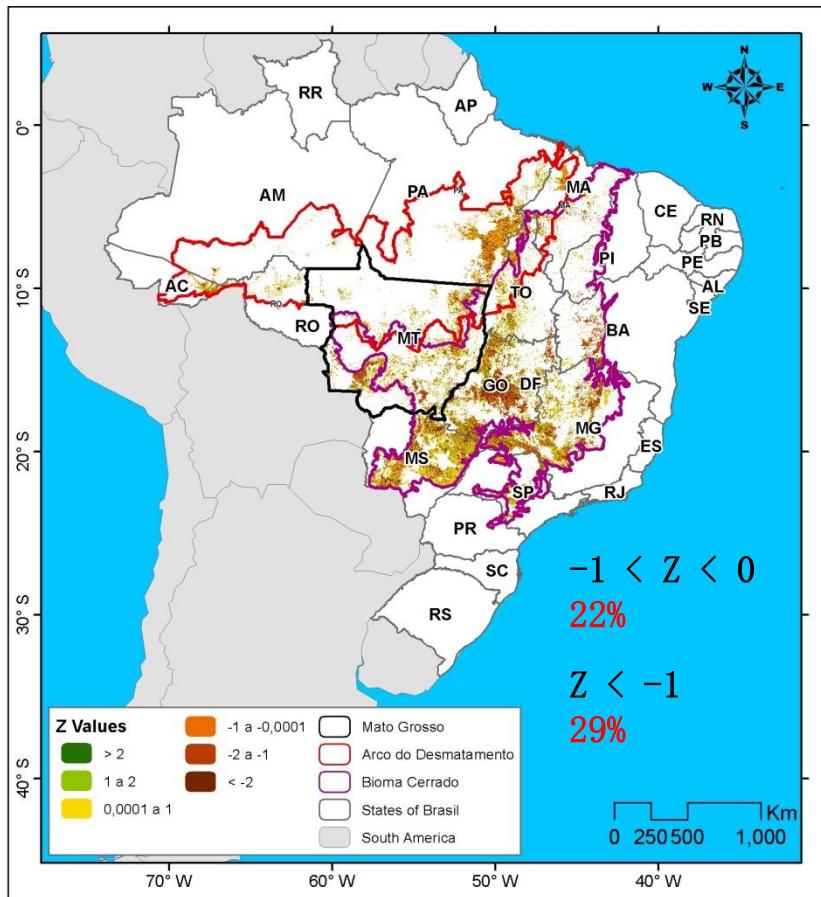
Seasonal Metrics: Net Primary Productivity

Net Primary Productivity (NPP)



Seasonal Metrics: NPP + Green-up rate

NPP + Green-up rate

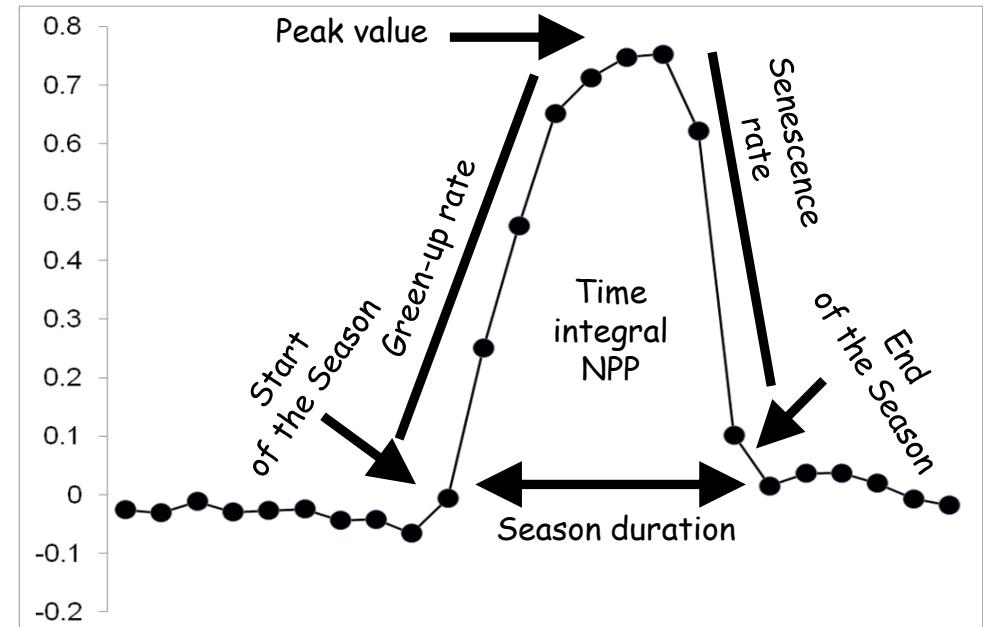
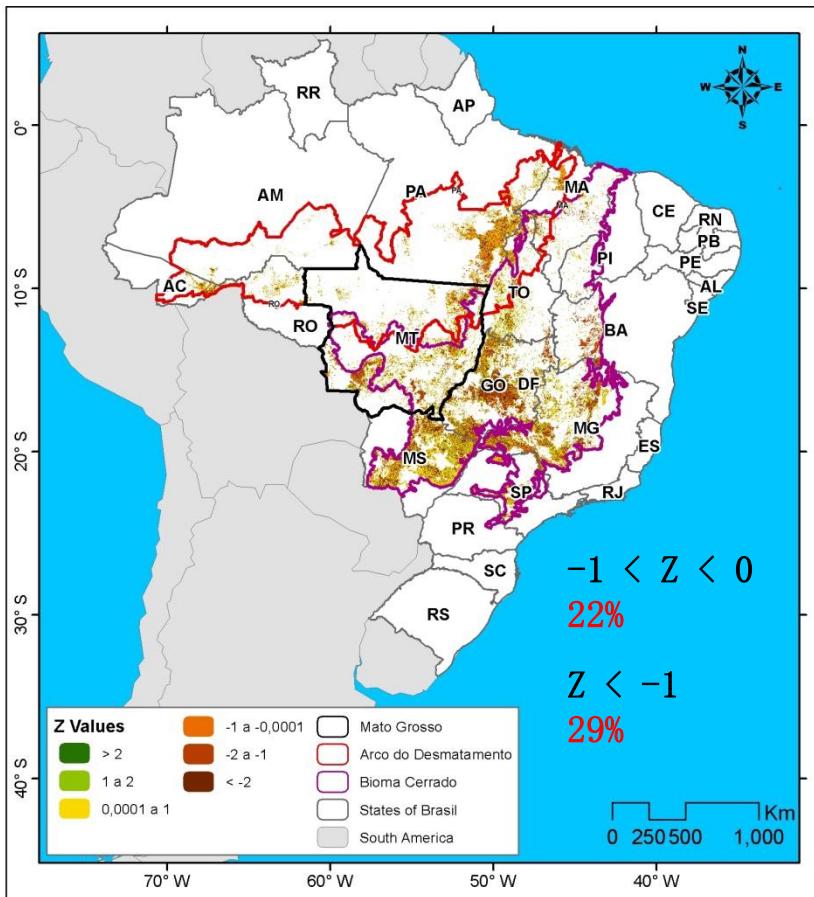


Seasonal Metrics: Challenges...

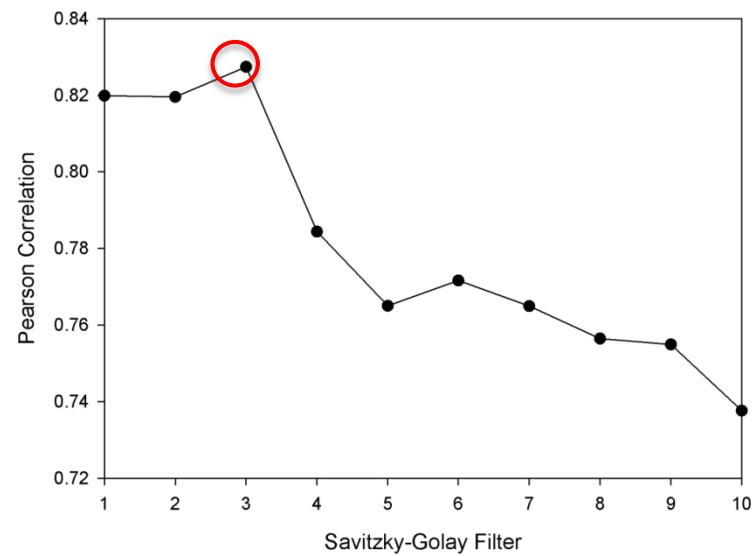
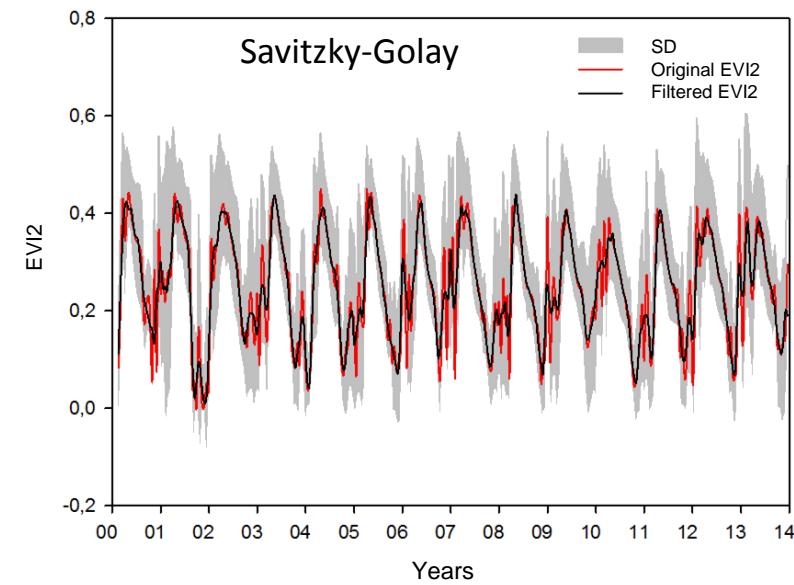


NPP + Green-up rate

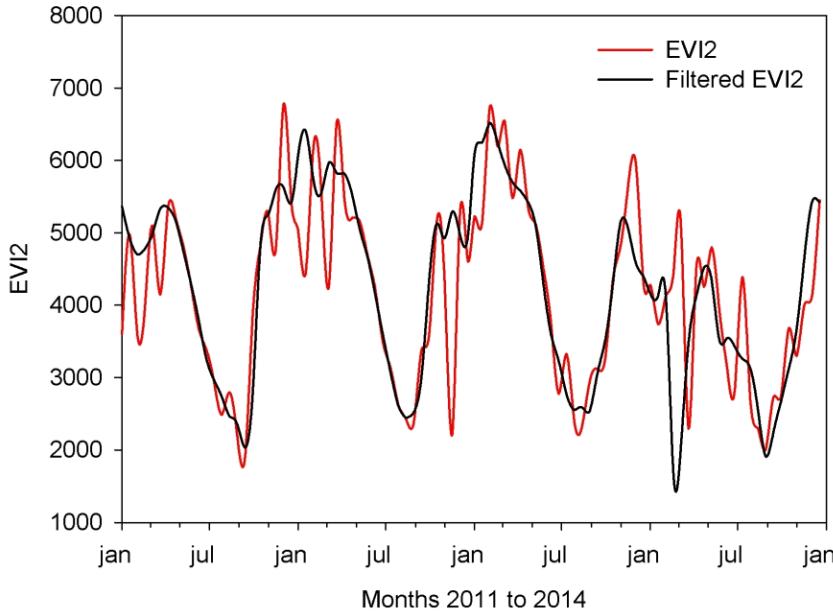
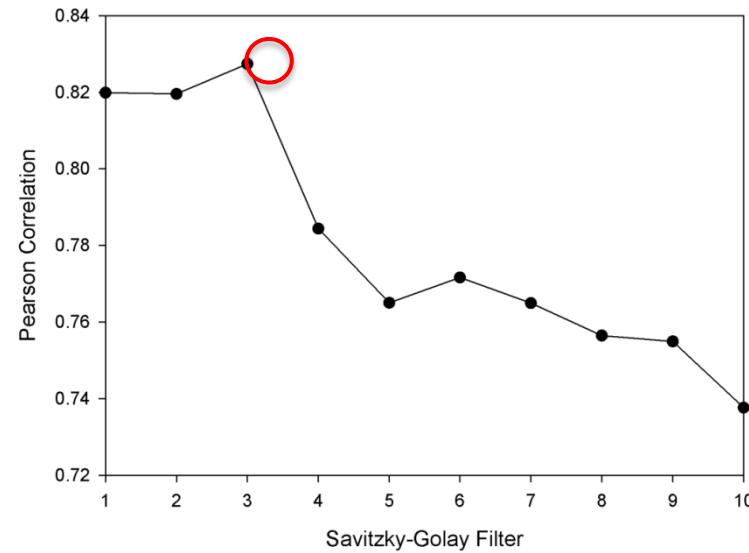
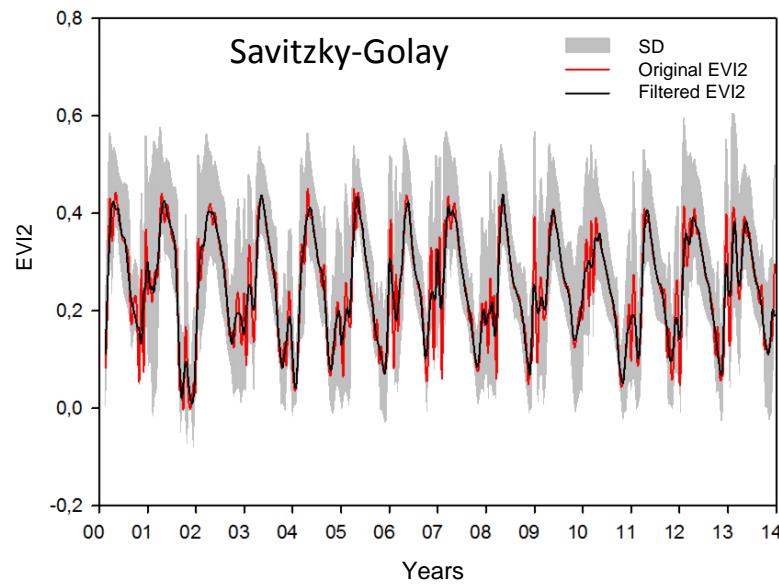
How to combine / weigh?



Challenges: How to create “good data”?



Challenges & Limitations

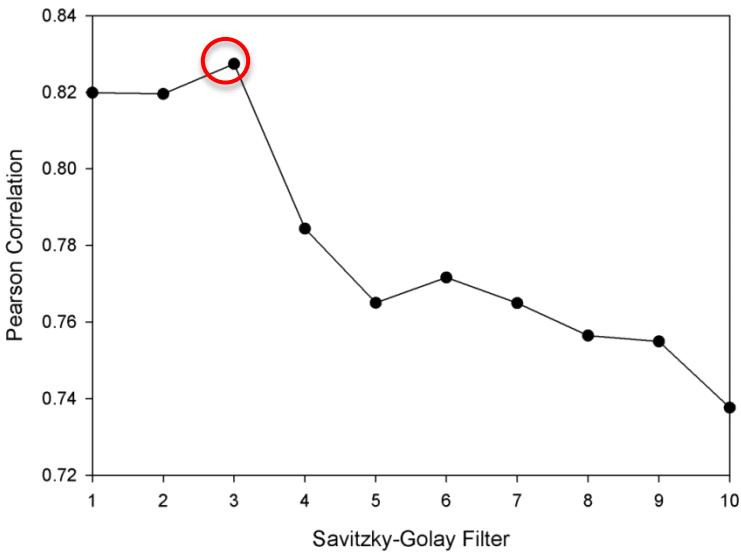
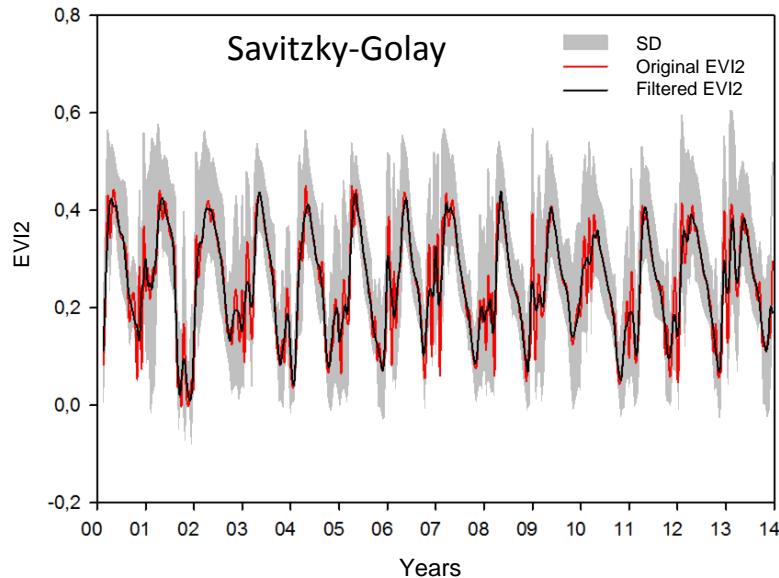


Limitations

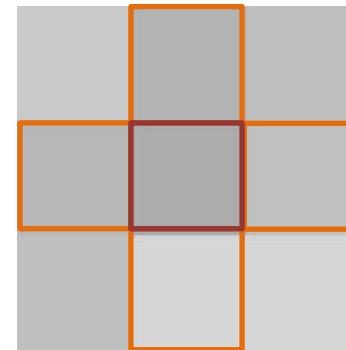
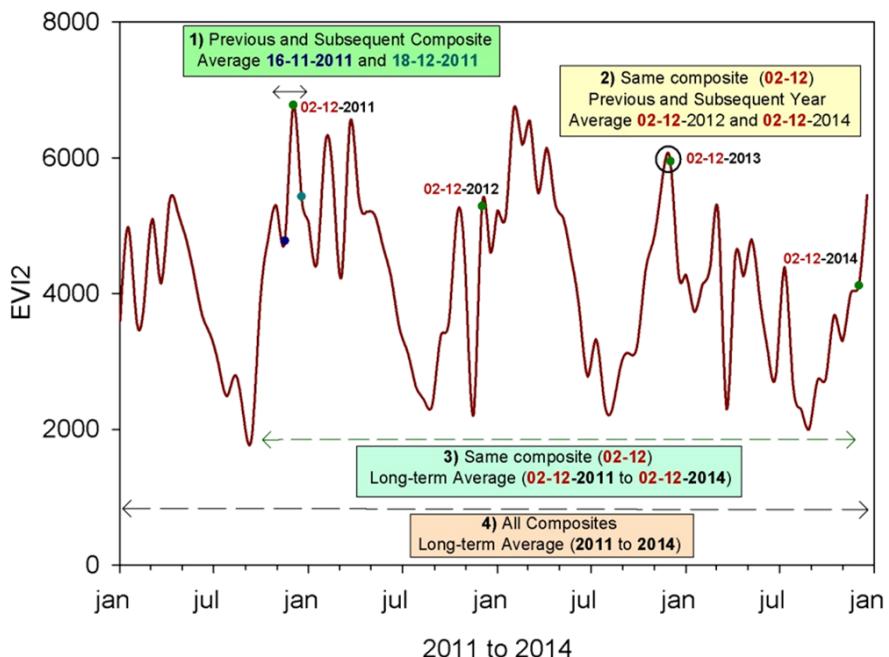
Savitzky-Golay Filter ➔ Large Seasonal Patterns

Pasture Quality ➔ “Noise”

Challenges & Solutions (?)



“New” Gap-filling approach



Actual prediction:
weighted sum of all of
the available inputs

What does pasture degradation mean?

Degradation - a **decline to a lower condition, quality or level**

❖ Degradation requires **a previous state or condition in time.**

❖ It varies according to:

Location



Forage species



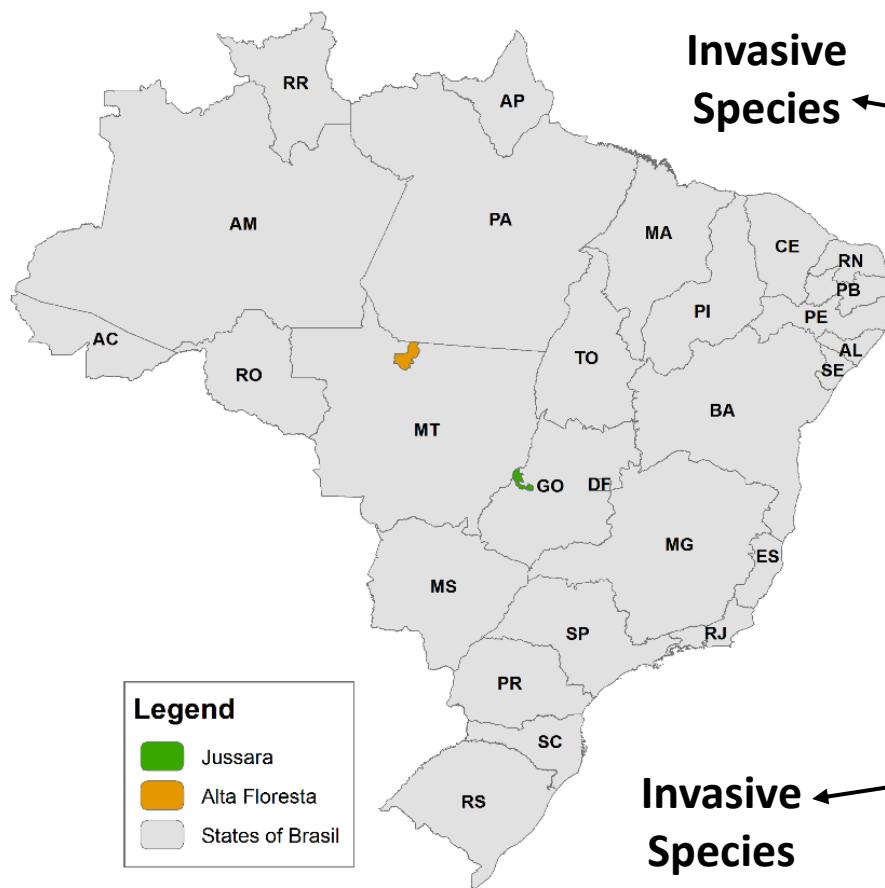
Mombaça



Braquiário

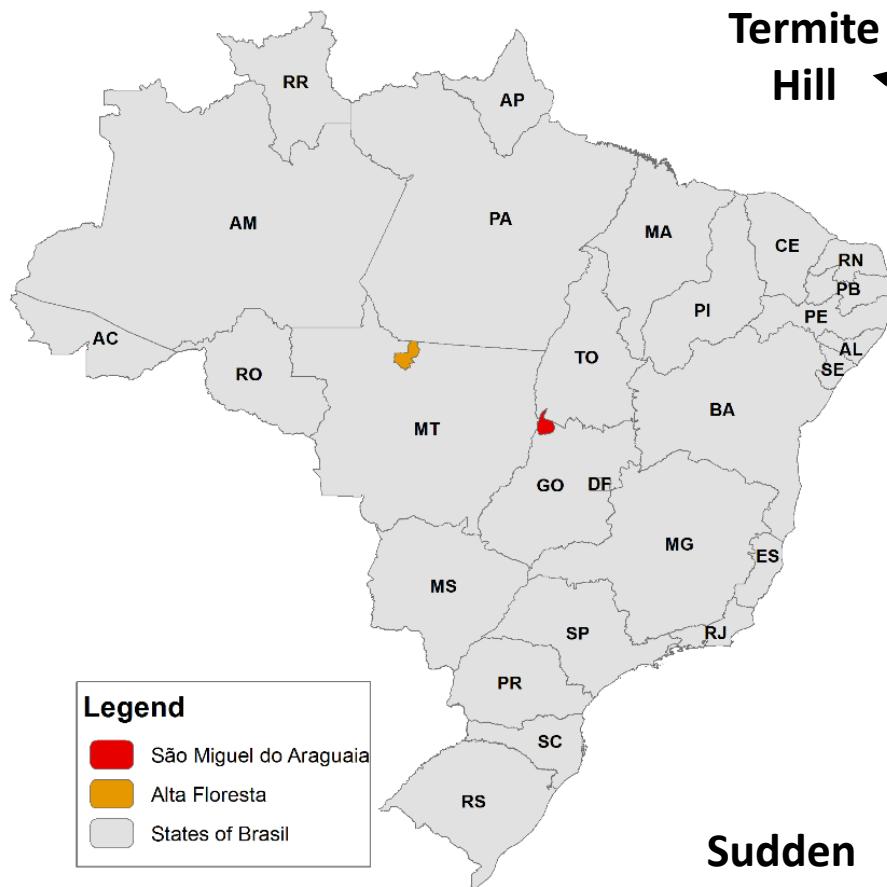
What does pasture degradation mean?

“Agronomic Degradation”



What does pasture degradation mean?

“Ecological Degradation”

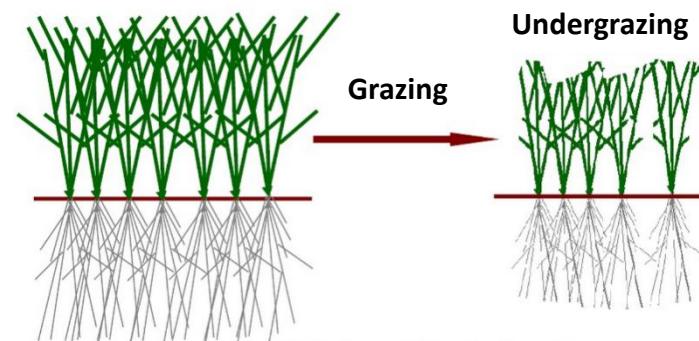
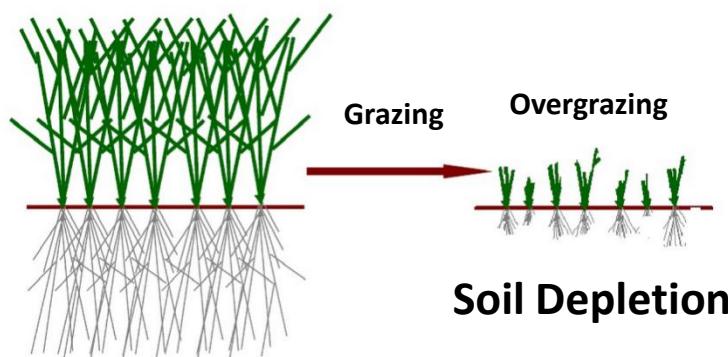
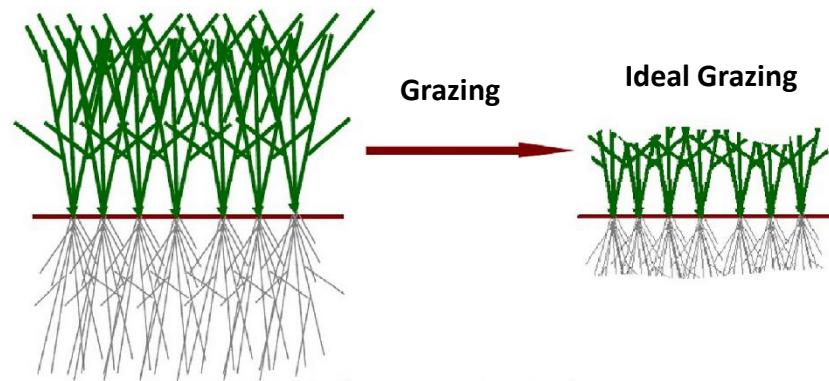


What does pasture degradation mean?

Pasture Degradation



Soil Degradation



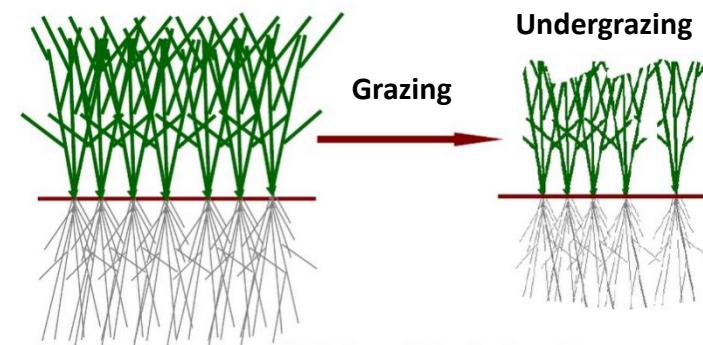
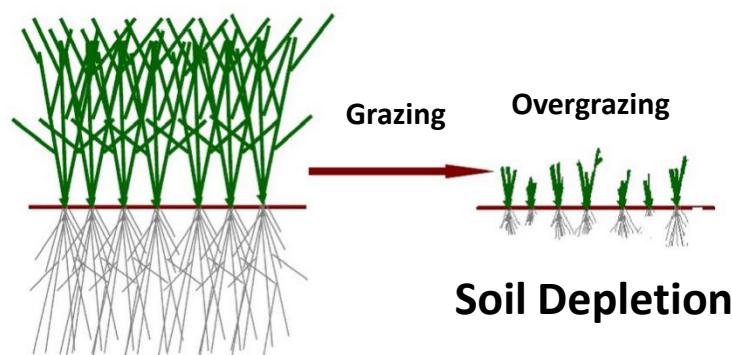
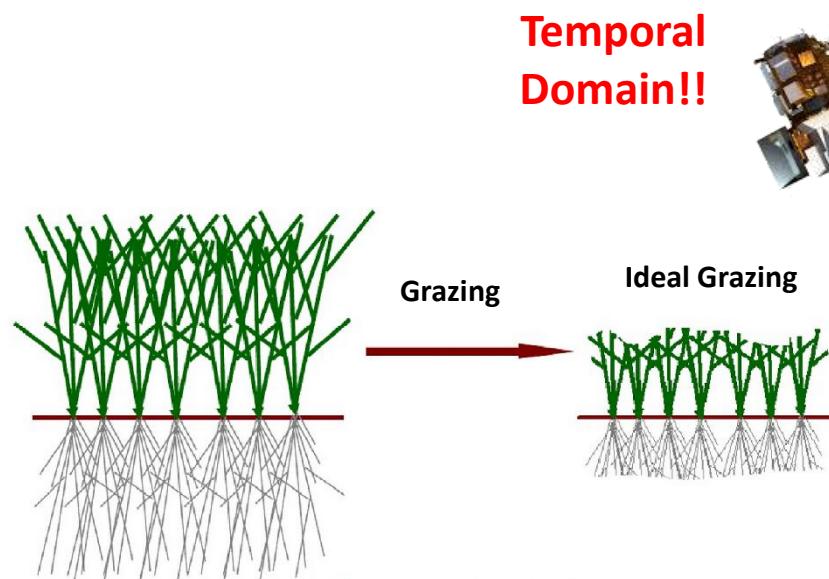
Encroachment and Lignin Enhancement

What does pasture degradation mean?

Pasture Degradation



Soil Degradation



Encroachment and Lignin Enhancement

What does pasture degradation mean?

Pasture Degradation



Soil Degradation



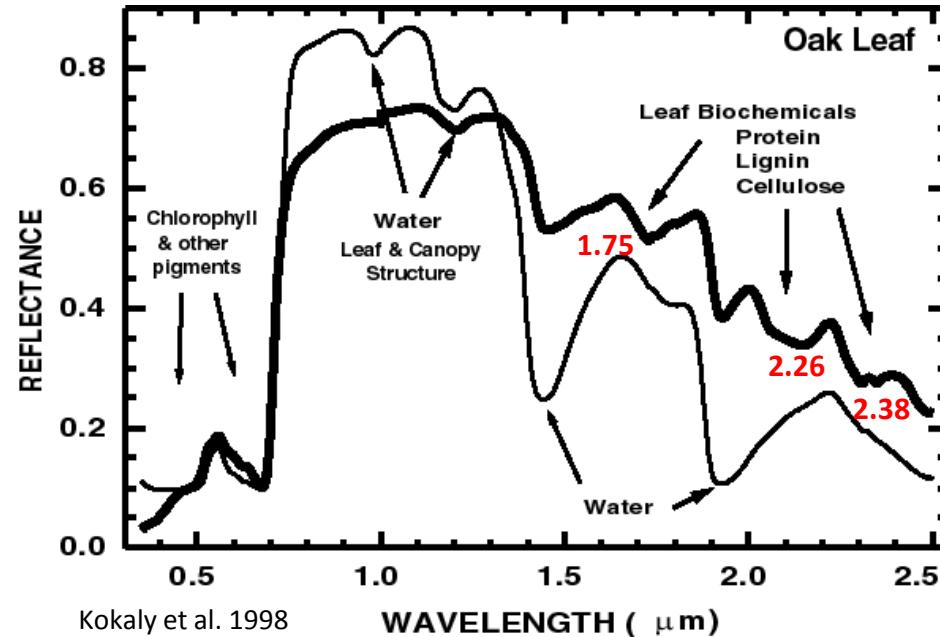
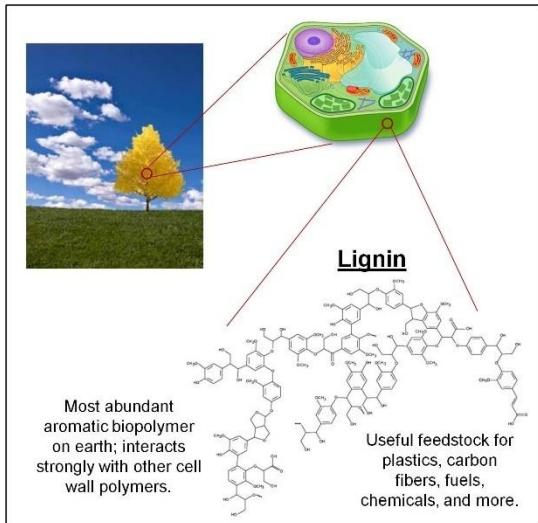
Pasture species according to soil fertility

	Rest period (Days)	Height of pasture (cm)	
		Input	Output
<i>Panicum Mombaça</i>	28 to 32	90	30 to 50
<i>Panicum Tanzania</i>	30 to 35	70	30 to 50
<i>Brachiaria Brizantha</i>	30 to 35	25	10 to 15
<i>Brachiaria Decumbens</i>	25 to 30	20	5 to 10
<i>Brachiaria Humidicola</i>	20 to 25	25	15 to 20

What does pasture degradation mean?

Hyperspectral Broad and Narrow-Band Vegetation Index	Narrow Band Formula	Sentinel 2 Equivalent or Surrogate	MODIS Equivalent or Surrogate	VIIIRS Equivalent or Surrogate
NDVI (Normalized Difference Vegetation Index)	$\frac{(R_{803} - R_{681})}{(R_{803} + R_{681})}$	$\frac{(R_{865} - R_{665})}{(R_{865} + R_{665})}$	$\frac{(R_{858} - R_{645})}{(R_{858} + R_{645})}$	$\frac{(R_{865} - R_{640})}{(R_{865} + R_{640})}$
CRI1 (Carotenoid Reflectance Index I; Gitelson et al., 2002)	$\left(\frac{1}{R_{510}}\right) - \left(\frac{1}{R_{550}}\right)$	$\left(\frac{1}{R_{490}}\right) - \left(\frac{1}{R_{560}}\right)$	$\left(\frac{1}{R_{488}}\right) - \left(\frac{1}{R_{555}}\right)$	$\left(\frac{1}{R_{488}}\right) - \left(\frac{1}{R_{555}}\right)$
ARI1 (Anthocyanin Reflectance Index; Gitelson et al., 2001)	$\left(\frac{1}{R_{550}}\right) - \left(\frac{1}{R_{700}}\right)$	$\left(\frac{1}{R_{560}}\right) - \left(\frac{1}{R_{705}}\right)$	$\left(\frac{1}{R_{555}}\right) - \left(\frac{1}{R_{678}}\right)$	$\left(\frac{1}{R_{555}}\right) - \left(\frac{1}{R_{672}}\right)$
RGR (Red-Green Ratio; Sims & Gamon, 2002)	$\frac{R_{600-699}}{R_{500-599}}$	$\frac{R_{665}}{R_{560}}$	$\frac{R_{645}}{R_{555}}$	$\frac{R_{672}}{R_{555}}$
NDII (Normalized Difference Infrared Index; Hardisky et al., 1983)	$\frac{(R_{819} - R_{1649})}{(R_{819} + R_{1649})}$	$\frac{(R_{842} - R_{1610})}{(R_{842} + R_{1610})}$	$\frac{(R_{858} - R_{1640})}{(R_{858} + R_{1640})}$	$\frac{(R_{865} - R_{1610})}{(R_{865} + R_{1610})}$
PSRI (Plant Senescence Reflectance Index); Merzlyak et al., 1999)	$\frac{(R_{680} - R_{500})}{(R_{750})}$	$\frac{(R_{665} - R_{560})}{(R_{740})}$	$\frac{(R_{645} - R_{531})}{(R_{748})}$	$\frac{(R_{672} - R_{555})}{(R_{746})}$
SATVI (Soil Adjusted Total Vegetation Index; Marsett et al., 2006)(Landsat-based)	$\frac{\left(\frac{(R_{1650} - R_{680})}{(R_{1650} + R_{680} + L)}\right)}{(1 + L) - \frac{R_{2215}}{2}}$	R ₁₆₁₀ , R ₆₆₅ , R ₂₁₉₀	R ₁₆₄₀ , R ₆₄₅ , R ₂₁₃₀	R ₁₆₅₀ , R ₆₄₀ , R ₂₂₅₀
CAI (Cellulose Absorption Index; Nagler et al., 2003); SWIR32 (Short Wave Infrared Reflectance 3/2 Ratio; Guerschman et al., 2009)	0.5(R ₂₀₀₀ + R ₂₂₀₀) - R ₂₁₀₀	$\frac{R_{2190}}{R_{1610}}$	$\frac{R_{2130}}{R_{1640}}$	$\frac{R_{2250}}{R_{1610}}$

Hill et al. 2013, Remote Sensing of Environment



Using forage level as a proxy...

Can optical remote sensing detect pasture degradation?

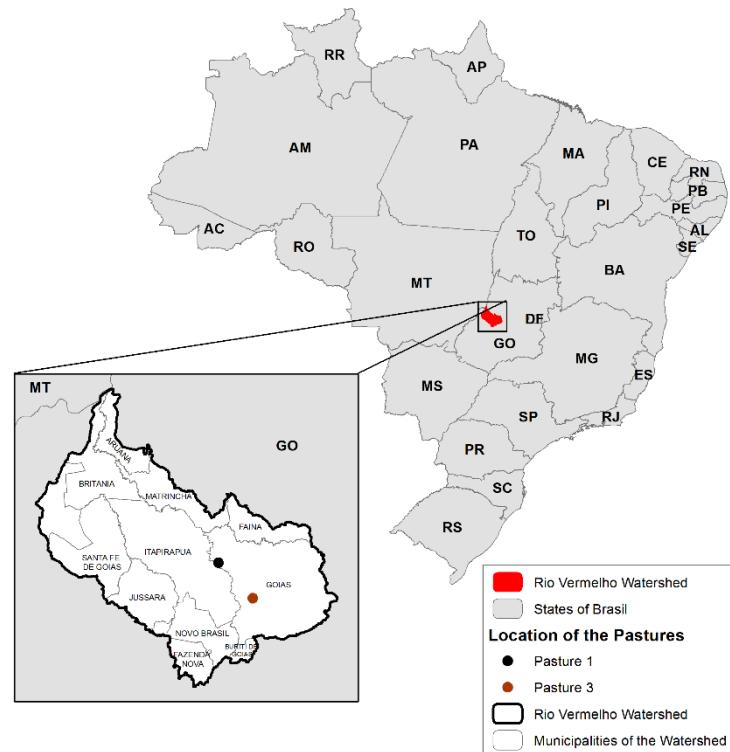
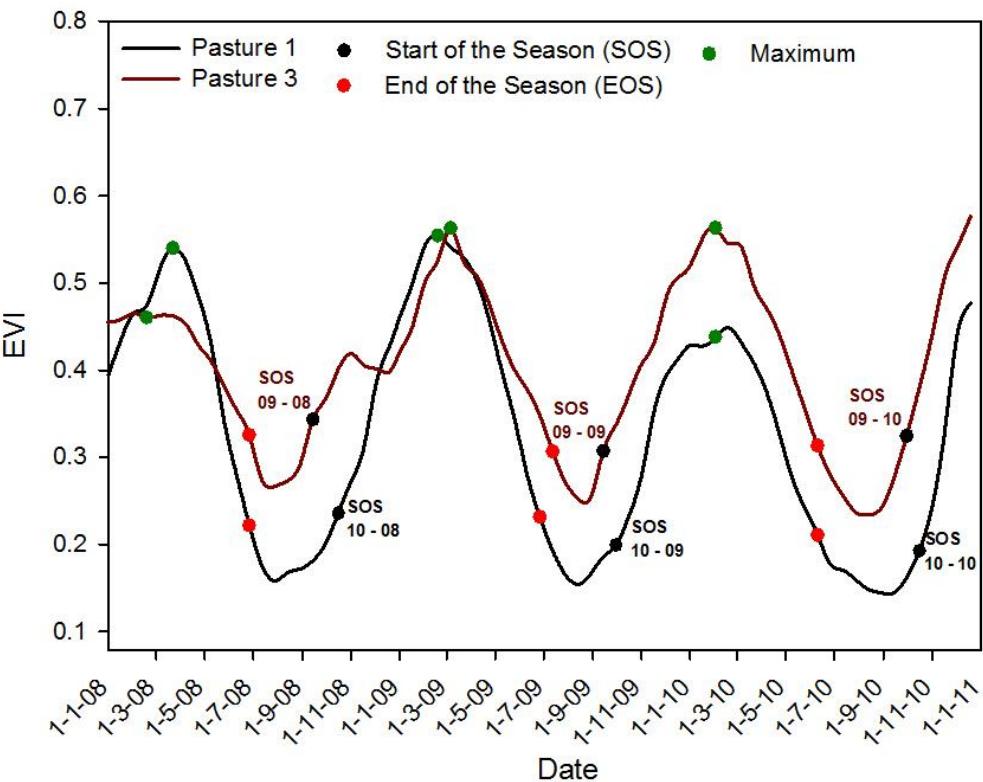
Douradinho Farm
31/10/2013



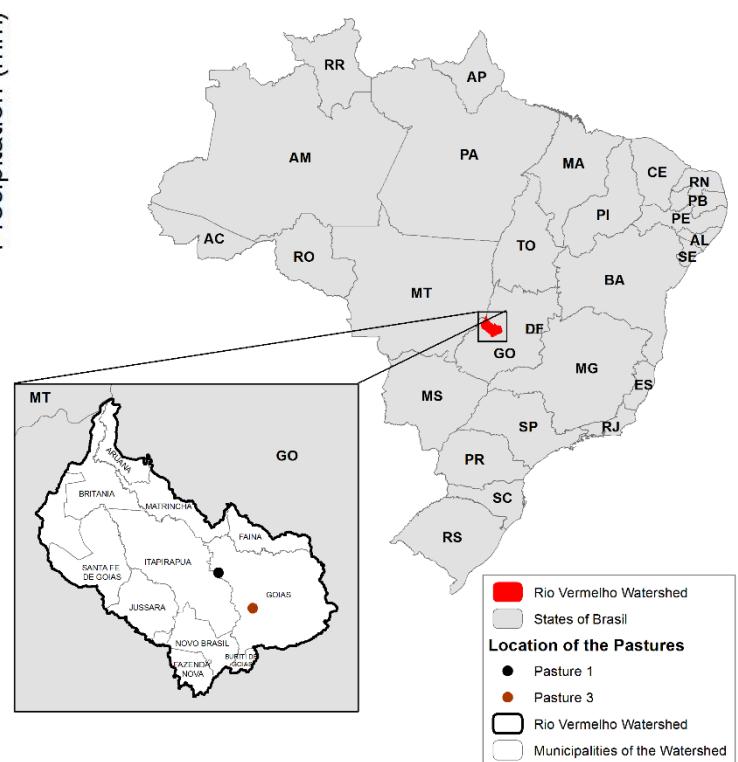
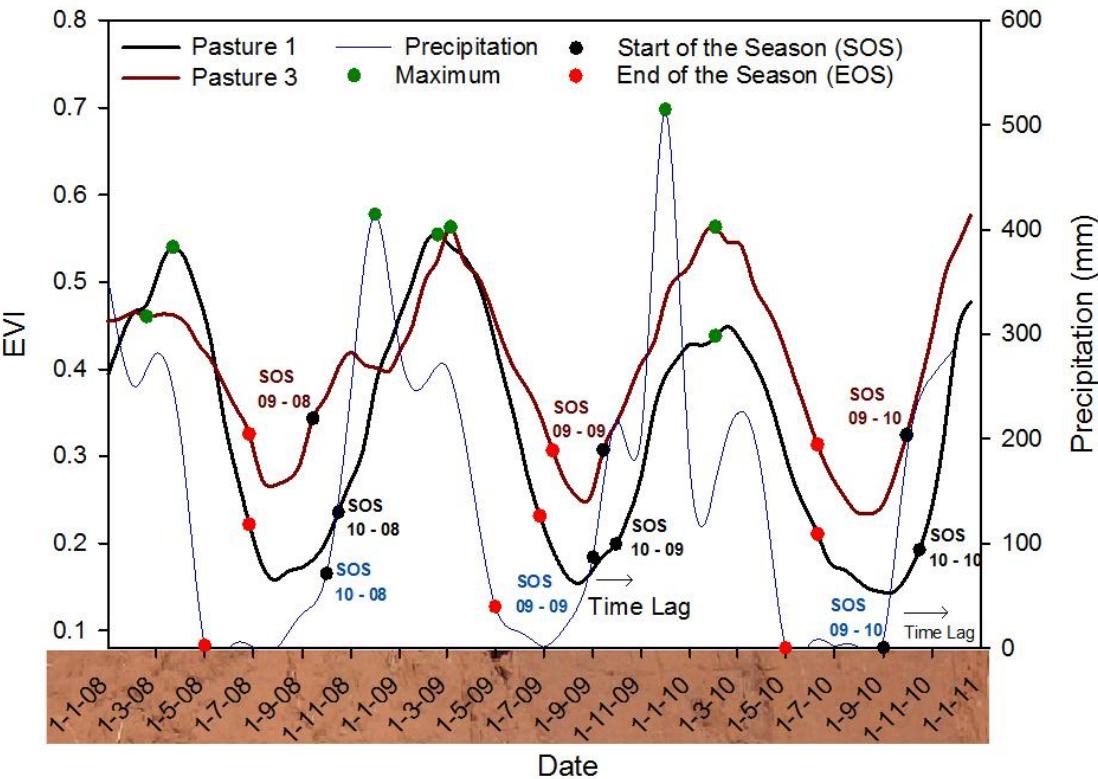
Gloria Farm
31/10/2013



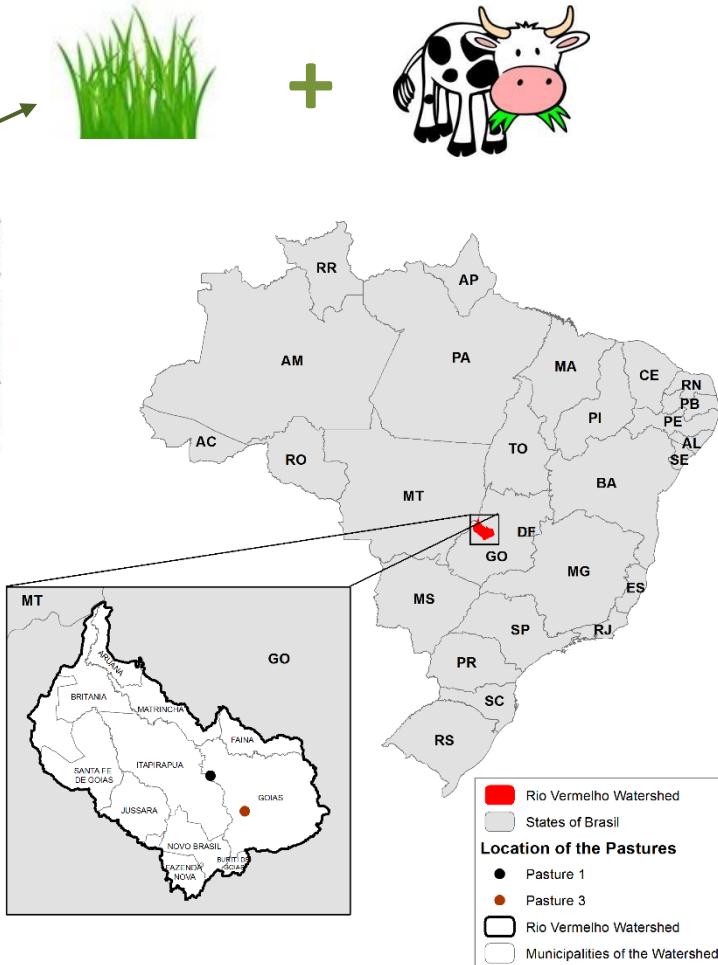
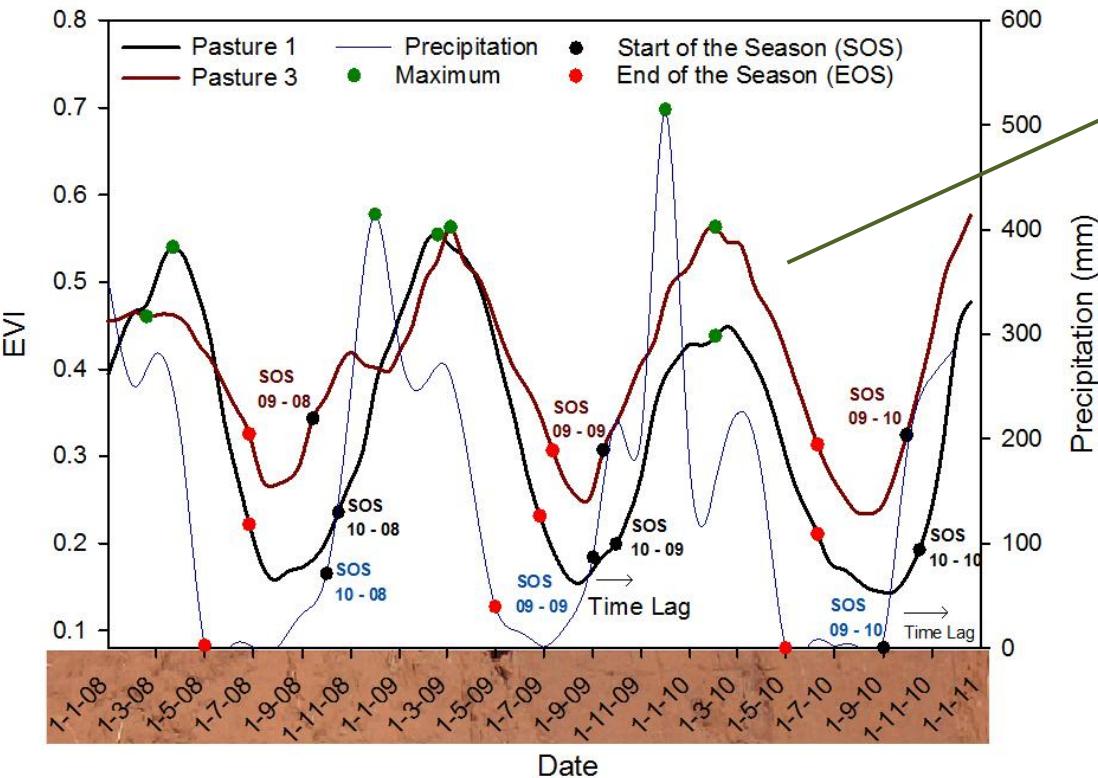
EVI Responses to Quality / Degradation stages?



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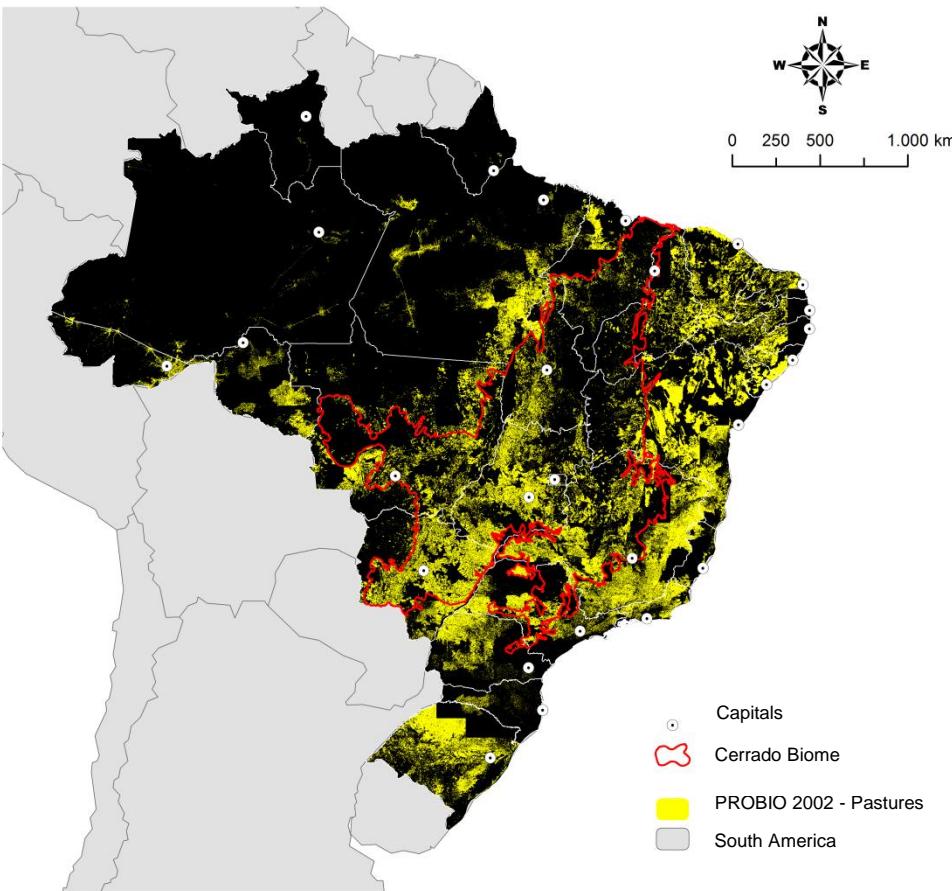


Pastures & Ecossistem Services

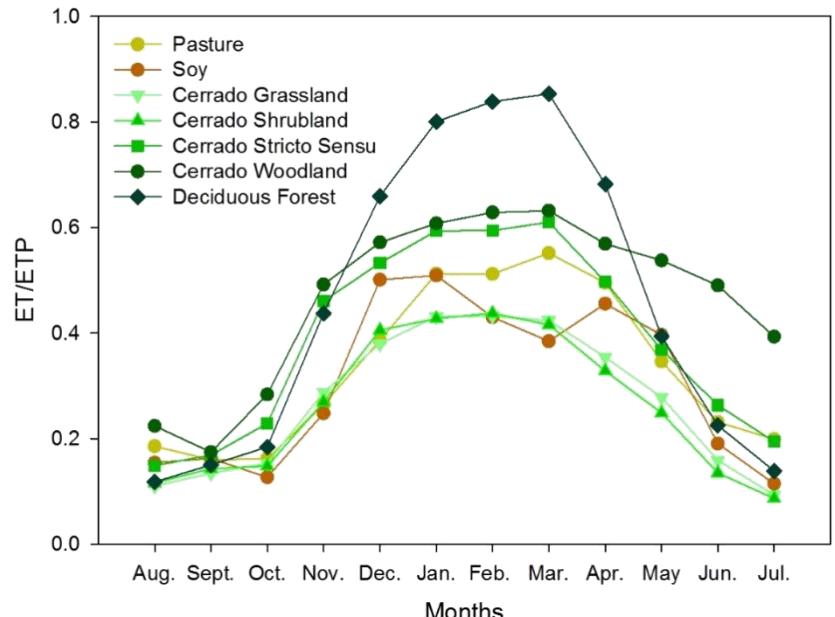
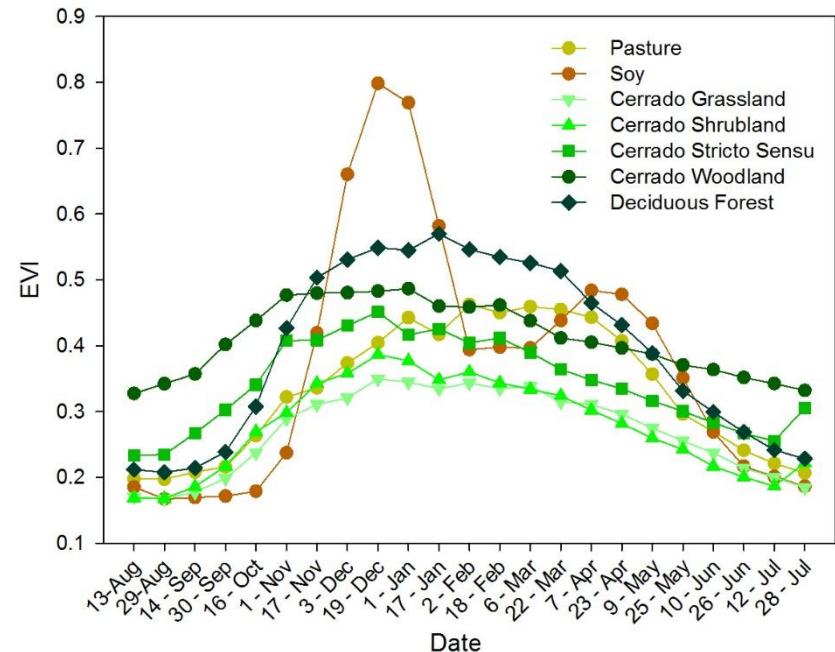
An aerial photograph of a green pasture. The land is covered in short grass with some darker patches and scattered trees. In the upper right, a group of cattle is gathered under the shade of a large tree. A few other smaller trees are scattered across the field. The terrain shows some slight slopes and a dirt path or fence line.

Rio Vermelho watershed (Goiás), March 2013

Emerging ecosystem...



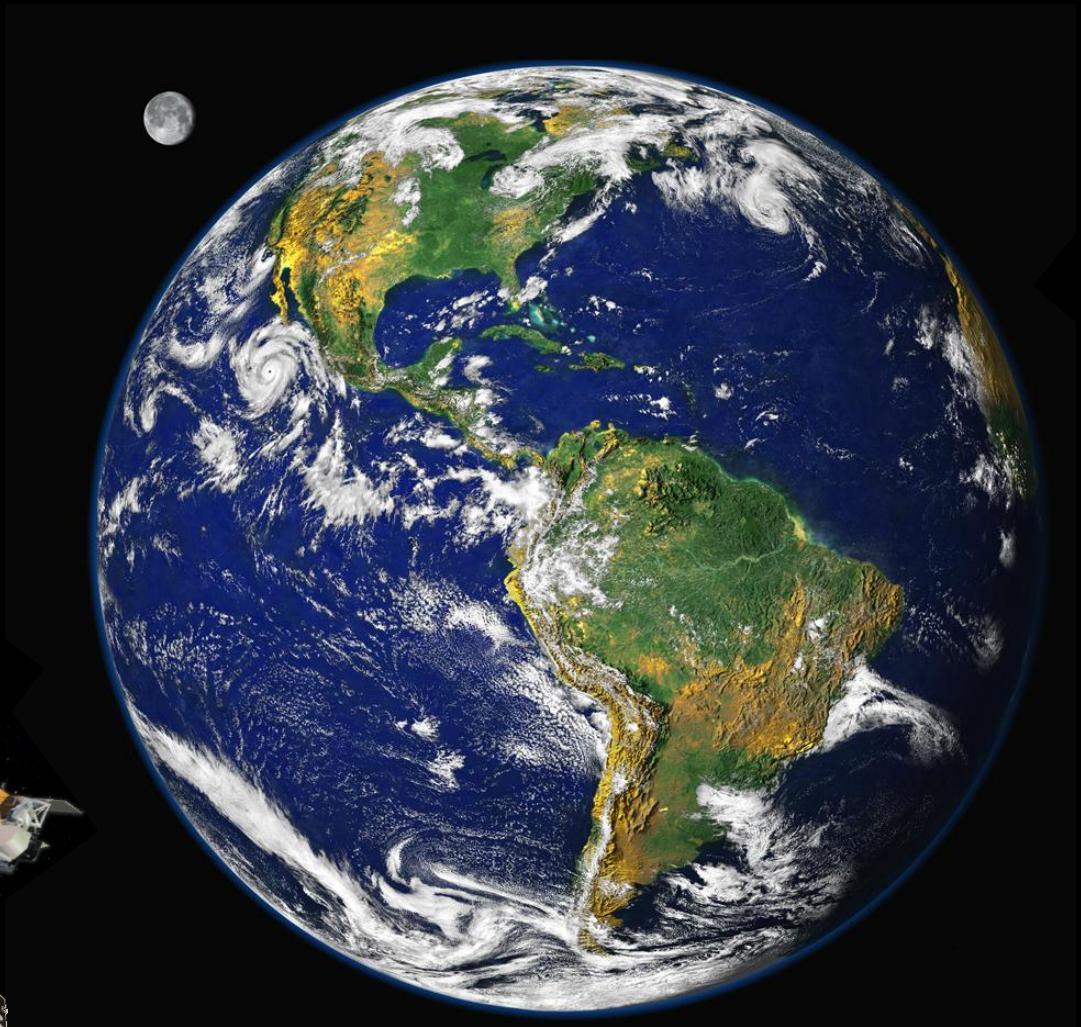
Reducing
Emissions from
Pasture degradation
REPD





TERRA





Thank you!