



Landscape ecology approaches for the conservation of Pantanal and Everglades vegetation

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Everglades

limestone

shallow basin surrounded by the ocean

Influenced by sea level, rise and fall

Pantanal

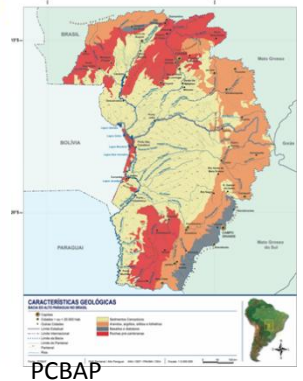
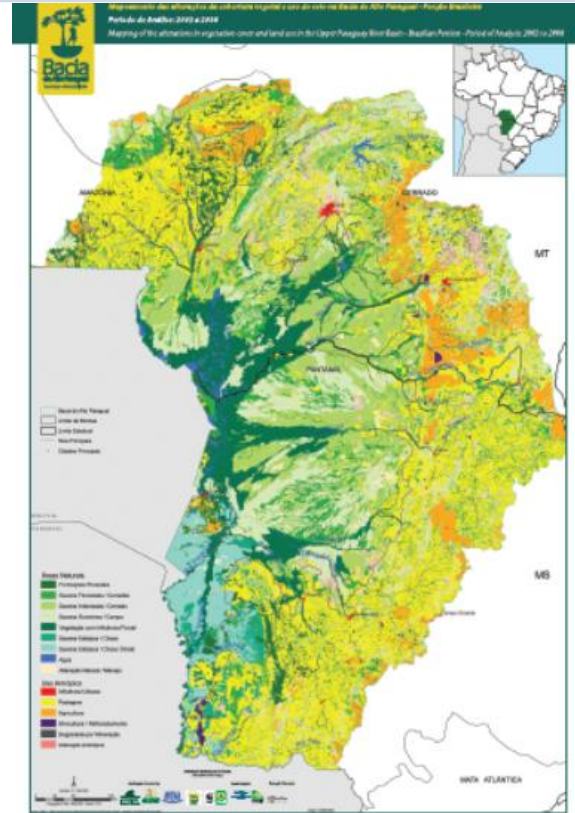
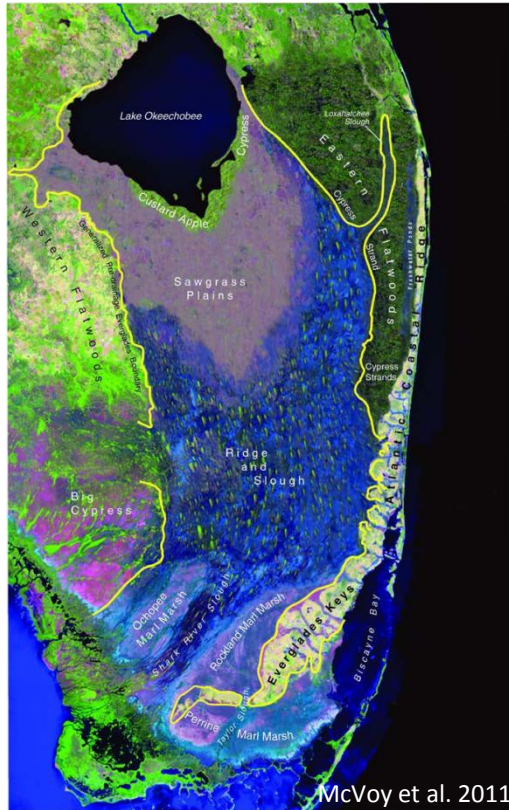
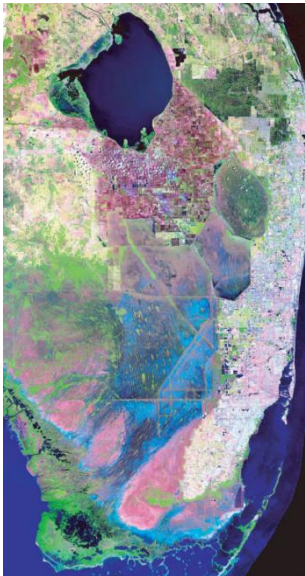
Recent alluvial sediments

floodplain ecosystems surrounded by uplands that drain into a broad

Influenced by variable climatic regimes

Predrainage

Extant



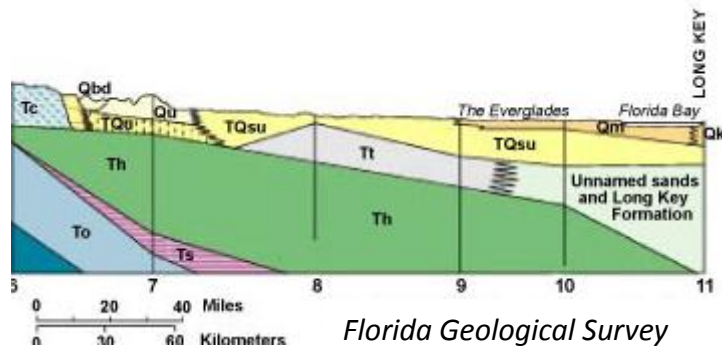
The Everglades originally area of approximately 12,000 km²

The Pantanal Brasil side covered an area of approximately 140,000 km²

Everglades

Bedrock : Limestone sediments

Topography and vegetation parallel to direction of flow (ridge/slough/tree island)



Florida Geological Survey

Pantanal

Recent alluvial sediments

Water river: direction of the river and channels, lakes paleo rivers; N-S; L-O. Rain water, eg., the termite mounds don't have directions"

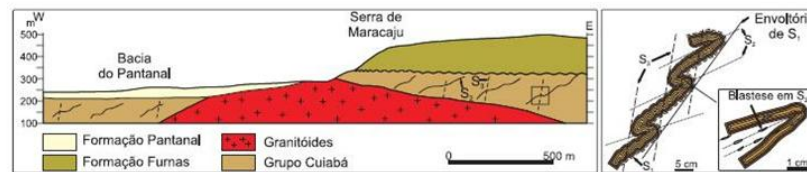
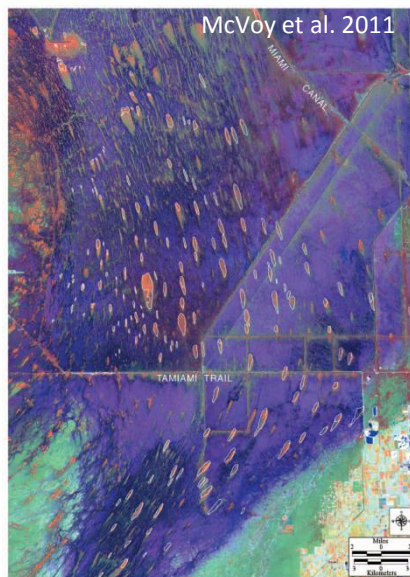
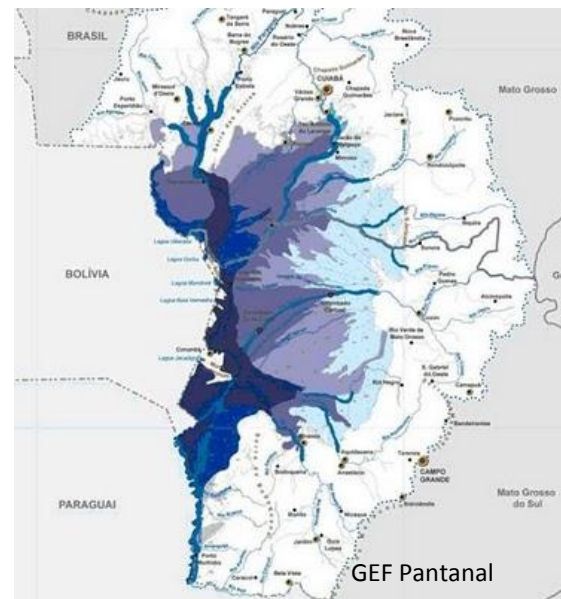


FIGURA 7. A) Perfil geológico esquemático do Maciço Coxim, Grupo Cuiabá e as demais litologias; B) Esquema ilustrativo das fases deformacionais e suas relações espaciais.

MANZANO et al 2008



McVoy et al. 2011



GEF Pantanal

Everglades FIRE

well documented from mid twentieth century



Pantanal FIRE

Began to be recorded in 2007

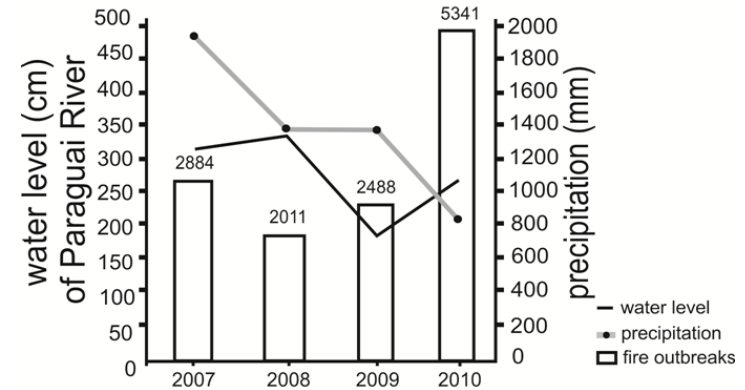
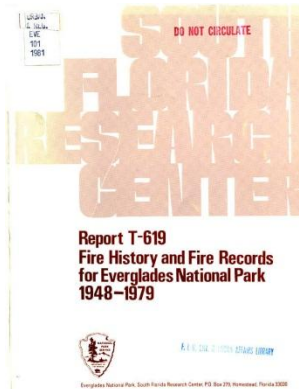
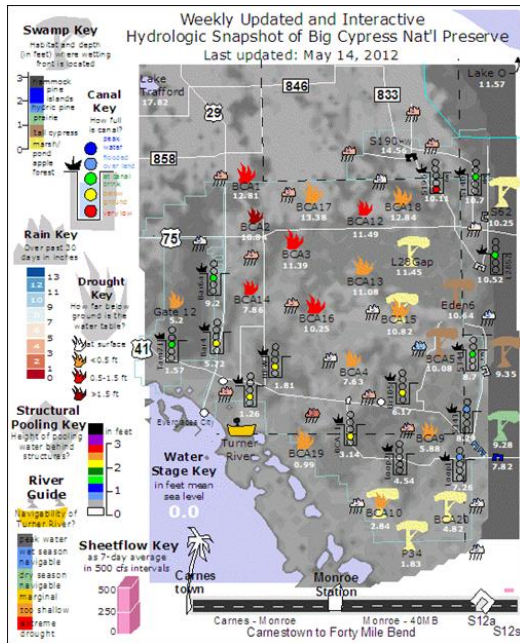


Fig. 3 Fire frequency, precipitation and water level fluctuation in the Pantanal. Precipitation data for Cuiabá from Instituto Nacional de Meteorologia (INMET), water level data for Ladário from Agência Nacional de Águas (ANA), and number of fires from Instituto Nacional de Pesquisas Espaciais (INPE), for the period of 2007-2010 from satellite NOAA-15

W. J. Junk , C.Nunes da Cunha (2012)

Fire has a natural role in shaping plant communities in both ecosystems, but the role of this driver is not fully understood in either.

Identified Hierarchy of Ecological Habitats: 8 primary classes, up to 6 levels within a class

Rutchev et al. (2006); see also Fitz and Trimble (2006) apud William J. Mitsch, Lawrence E. Band, and Carl F. Cerco (2007)



South Florida Information Access

publications > open file report > SFR 2006-1240 > figure & table list > table.1 > shrubland

Table 1. Vegetation classification descriptors table - Shrubland

Class ID	Raster ID	Name	Level	Description	Location	Reference
S	300000	Shrubland	1	High-density stands of small trees and/or shrubs (>50% tree/shrub canopy cover) with heights less than five meters. Exception: Mangrove shrubs less than or equal to 2 meters are scrub - see scrub section.	Found throughout Florida.	
SM	310000	Mangrove Shrubland	2	Regularly flooded shrublands that are typically found along saltwater shorelines, including Black Mangrove (<i>Avicennia germinans</i>), White Mangrove (<i>Laguncularia racemosa</i>), Red Mangrove (<i>Rhizophora mangle</i>), Buttonwood (<i>Conocarpus erectus</i>), and Sea-Oxeye (<i>Borreria</i> spp.). Canopy heights are generally less than five meters and greater than two meters.	Found along coastal Florida.	
SMa	311000	Black Mangrove Shrubland	3	Black Mangrove (<i>Avicennia germinans</i>) dominant shrubland. Black mangrove is distinguishable from other mangrove species by leaves with grayish undersurfaces, by green, flattened "lima bean-like" fruits, by dark to blackish bark, and by the presence of numerous short breathing roots projecting vertically from the ground below and around the tree.	Found along coastal Florida. Predominates in the upper part of the intertidal zone and into the irregularly flooded higher elevations; common forest fringing Florida Bay along Snake Bite in ENP; sometimes found on higher drier soils than the red or white mangrove. However, it can be found among any of the other Mangrove communities.	
SMb	312000	Sea-Oxeye Shrubland	3	Sea-Oxeye (<i>Borreria arborescens</i>) dominant shrubland.	Typically found in coastal areas of BISC and southern EVER where tidal flooding is common.	
SMc	313000	Buttonwood Shrubland	3	Buttonwood (<i>Conocarpus erectus</i>) dominant shrubland; often mixed with sparse Coccoloba (<i>Chrysobalanus icaco</i>), Wax Myrtle (<i>Myrica cerifera</i>), and/or Red Mangrove (<i>Rhizophora mangle</i>).	Generally coastal in distribution, normally found along the landward edge of the mangrove zone and along the edges of hammocks bordering the transition zone between freshwater and saltwater environments; thriving in areas that are only occasionally subjected to tidal washing (e.g., elevated ridges in or near the tidal zone); southern Florida and the Keys; more specifically found along the Buttonwood ridge in ENP and around Coot Bay. However, it can be found among any of the other Mangrove communities.	
SMi	314000	White Mangrove	3	White Mangrove (<i>Laguncularia racemosa</i>) dominant shrubland.	Found along coastal Florida. Occurs throughout	

Table 1. Vegetation classification descriptors table - Marsh

Class ID	Raster ID	Name	Level	Description	Location	Reference
M	500000	Marsh	1	Graminoid and/or herbaceous emergent or floating vegetation in shallow water that stands at or above the ground surface for much of the year.	Found throughout Florida.	
MS	510000	Salt Marsh	2	A marsh consisting of salt tolerant graminoid and/or herbaceous vegetation.	Found along coastal Florida.	
MSG	511000	Graminoid Salt Marsh	3	Graminoid dominated salt marsh.	Found along coastal Florida.	
MSGd	511100	Saltgrass	4	Saltgrass (<i>Distichlis spicata</i>) dominated salt marsh.	Found in salt marshes and flats, brackish habitats and wet marl near the coast; frequent to common, throughout coastal Florida.	
MSGi	511200	Black Rush	4	Black Rush (<i>Juncus roemerianus</i>) dominated salt marsh.	Commonly found in tidal marshes; typical of southwest BICY and southern mainland BISC.	
MSGm	511300	Keysgrass	4	Keysgrass (<i>Monanthochloa littoralis</i>) dominated salt marsh.	Found in salty shores, tidal flats and salt marshes; frequent, coastal south, central, and north Florida.	
MSGs	511400	Cordgrass	4	Sand Cordgrass (<i>Spartina bakeri</i>) and/or Gulf Cordgrass (<i>S. spartinae</i>) dominated salt marsh.	Commonly found in tidal marshes. However, <i>Spartina bakeri</i> can also be found in freshwater marshes.	
MSGp	511500	Dropsseed	4	Dropsseed (<i>Sporobolus</i> spp.) dominated salt marsh.	Common throughout coastal Florida.	
MSH	512000	Herbaceous Salt Marsh	3	Herbaceous dominated salt marsh.	Found along coastal Florida.	
MSD	513000	Open Salt Marsh	3	Open water dominated salt marsh often with a mix of sparse graminoids and/or herbaceous salt marsh vegetation, such as Black Rush (<i>Juncus roemerianus</i>) and/or Cordgrass (<i>Spartina</i> spp.).	Found along coastal Florida.	
MSS	514000	Succulent Salt Marsh	3	Succulent dominated salt marsh.	Found along coastal Florida.	
MSB	514100	Saltwort	4	Saltwort (<i>Batis maritima</i>) dominated salt marsh	Found bordering salt ponds, marshes, salt flats and fringes of mangrove mud; common along Snake Bite in EVER.	
MSSa	514200	Glasswort	4	Glasswort (<i>Salicornia</i> spp.) dominated salt marsh.	Found in salt and brackish marshes and flats; throughout coastal regions of Florida; common along Snake Bite in EVER.	
MSSe	514300	Sea Purslane	4	Sea Purslane (<i>Sesuvium</i> spp.) dominated salt marsh.	Found on beaches, dunes, marshes and marsh banks, salt flats and meadows, mangrove fringes, and other wet open places; throughout coastal Florida.	

Identified Hierarchy Ecological Habitats: 5 hydrological status, 52 habitats

Catia Nunes da Cunha & Wolfgang J. Junk (2011)

Table 5.1 Preliminary classification of the habitats of the Pantanal

Hydrological status	Functional unit	Mesohabitat with botanical characterization (when possible)
1. Permanent aquatic systems		
1.1 Standing water		
1.1.1 Fresh water	Mesohabitats of all functional units of 1.1: Open water, vegetated shorelines, vegetation-free shorelines, substrate-defined patches, macrophyte-defined patches (<i>Eichhornia crassipes</i> , <i>E. azurea</i> , <i>Oxyaryum cubense</i> , <i>Salvinia auriculata</i> and many others)	
1.1.1.1 Oxbow lakes		
1.1.1.2 Large depression lakes at the border of the Pantanal		
1.1.1.3 Medium sized depression lakes inside the Pantanal		
1.1.1.4 Small lakes of paleo-fluvial activity		
1.2 Saline water		
1.2.1 Salinus	Salinus (no or few macrophytes, mainly <i>Oscillatoria</i> , <i>Aphanozoea</i> , <i>Anabaenopsis</i> (<i>Cyanobacteria</i>))	
1.3 Artificial systems		
1.3.1 Reservoirs		
1.3.2 Ponds (e.g., excavation ponds and trenches along earth roads)		
1.2 Running water		
1.2.1 River channels according to river order		
1.2.1.1 Central	Substrate defined patches	
5. Swamp systems (soils permanently or for long periods saturated or covered with water)		
5.1 Swamp systems predominantly covered with herbaceous vegetation		
5.1.1 Swamps in the transition zone to the upland <i>cerrado</i> (marshy grasslands)	<i>Schizachyrium tenerum</i> , <i>Echinochaena inflexa</i> , <i>Lundetia flammea</i> , <i>Erianthus asper</i> and many others	
5.1.2 Swamps in the Pantanal (<i>brejos</i>)		
5.1.2.1 Swamps with <i>Cyperus giganteus</i> (<i>Pirizal</i>)		
5.1.2.2 Swamps with <i>Thalia geniculata</i>		
5.1.2.3 Swamps with <i>Canna glauca</i> (<i>caitezal</i>)		
5.1.2.4 Swamps with high species diversity		
5.1.3 Dense periodically floating islands (<i>Batumei</i>) <i>Oxyaryum cubense</i> , <i>Ludwigia nerrosa</i> and many others		
5.2 Swamp systems covered with herbaceous plants and trees		
5.2.1 Swamps with <i>Mauritia flexuosa</i> (<i>Burizal</i>)		

Everglades

Ecological Habitats

1-Ridge/slough/tree island, 2&3-Pinelands, 4-Tropical hammock, 5-Coastal mangroves



Pantanal

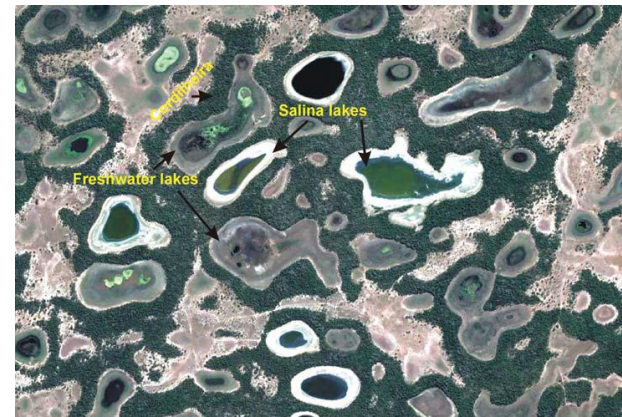
Ecological Habitats

1-Cordilheira, 2-Corixo, 3-lagoas, 4- isolated hills

Catia Nunes da Cunha & Wolfgang J. Junk (2011)



Fig. 12.2 Landscape units of the Northern Pantanal near Poconé: Remains of paleo-levees (*cordilheira* and *apêlo*), termite savanna (*campo de marandim*), and swamps (*brejo*) during falling water levels. The centres of the swamps are still shallowly flooded and become swamps only during the dry season. Foto: Google Earth,



Everglades

Vegetation types

Sawgrass marsh, water lily slough, sawgrass prairie and cypress domes, cypress swamp, mangrove forest



Pantanal

vegetation types

Swamps & marsh; Flooded grasslands; termite savanna; deciduous forest



Plant population expansion and invasibility

Everglades native species

Typha domingensis*, *Salix caroliniana

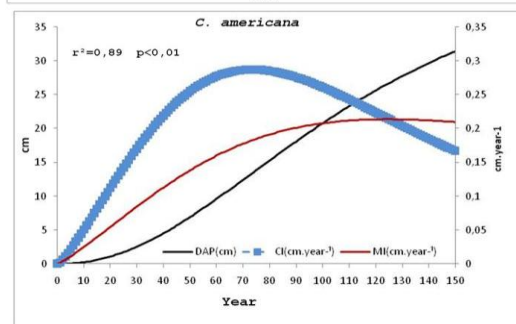
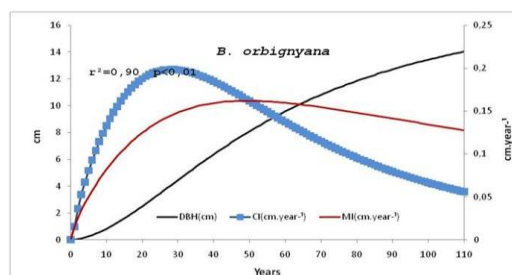
Pantanal native species

Vochysia divergens*, *Combretum laxum*, *Curatella americana*, *Byrsonima orbignyana

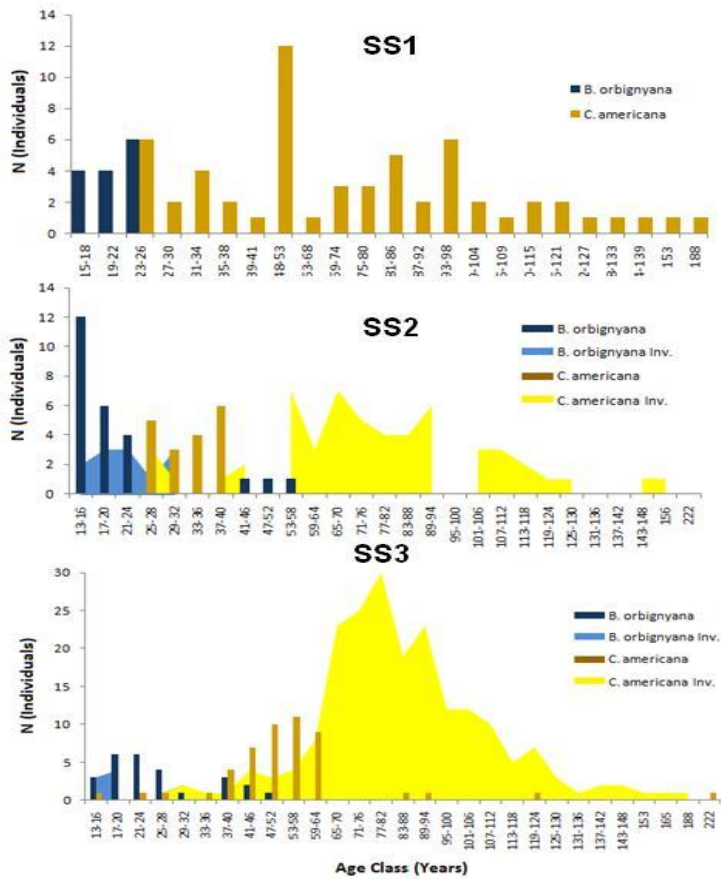


Dynamic Expansion of *Byrsonima orbignyana* e *Curatella americana* in termite savannas C. Pereira 2012

(15) 1 ha sampling plots



Dynamic Expansion of *B. orbignyana* and *C. americana*



Results

The dendrocronological dating show the *B. orbignyana* appears in 1977, and *C. Americana* with peaks between 1920 (89-94 years) and 1927 (77-82 years) And show to be related with the hydrological multiannual periods

Figure 2. Distribution of individuals of *B. orbignyana* and *C. americana* by age (years), stand stage 1 (SS1), 2 (SS2) and 3 (SS3). The bars represent the individuals sampled over the murunduns and the shaded areas represent the invasion of species over the natural grasslands in Pantanal de Poconé, MT.

Expansion of *Combretum laxum* in flooded grasslands

F. H. Barbosa (2011)



Seral-stage 1
Native grassland
(without woody expansion)



Seral-stage 2
Native grassland with *C. laxum*
(expansion in progress)



Seral-stage 3
monospecific *Combretum*
scrubland
(expansion final)

ANOVA
 $r^2 = 0.79$
 $F = 27.93$
 $df = 2$
 $p = 0.000$

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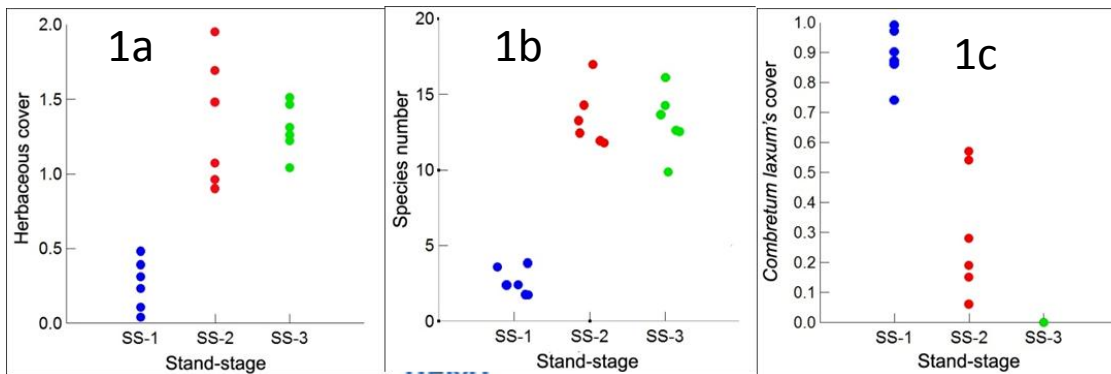
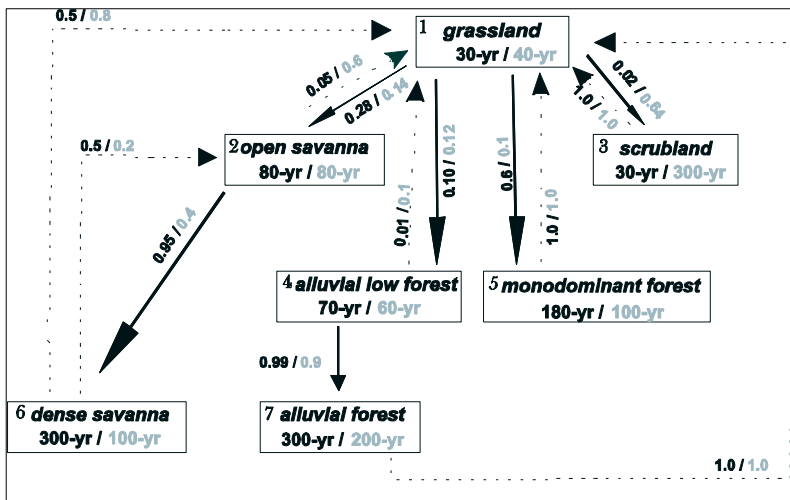


Figure 1: Relationship between stande-stages and herbaceous cover (1-a), species richness (1-b), *Combretum laxum's* cover (1-c). SS-1 – monospecific scrubland; SS-2 – native grassland with *C. laxum* and SS-3 – native grassland.

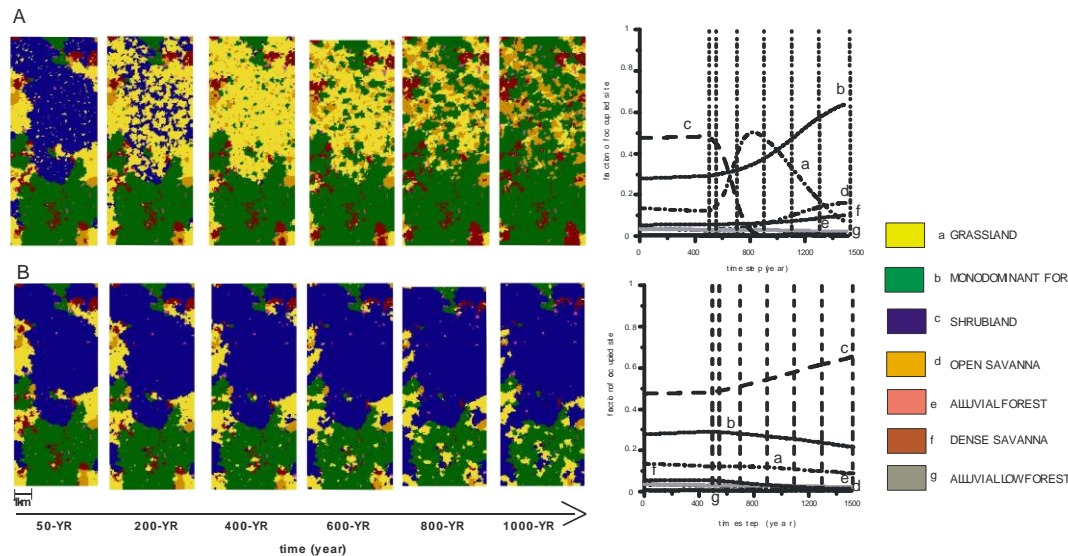
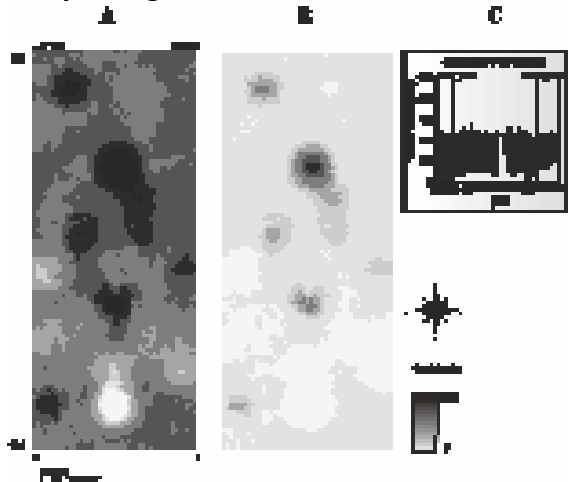
Simulated expansion/retraction of wetland vegetation types under different hydrological scenarios (J. Arieira et al juarieira@ufmt.br)

Conceptual Successional Model



Simulated spread of seven vegetation types under wetter and drier hydrological years

Hydrological scenarios



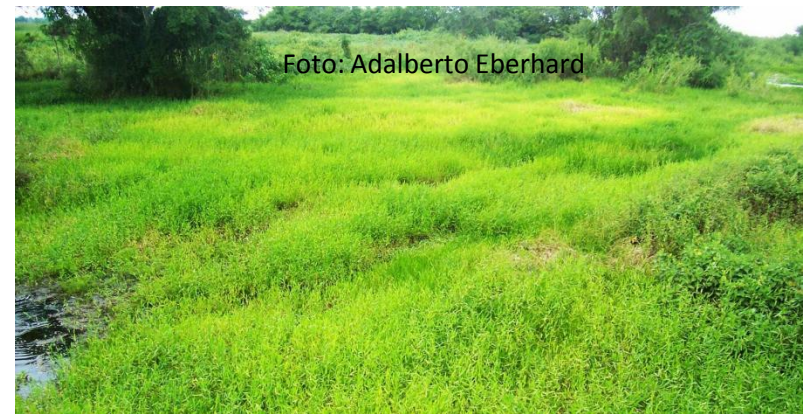
Everglades Exotic Species

Melaleuca quinquenervia*, *Lygodium microphyllum

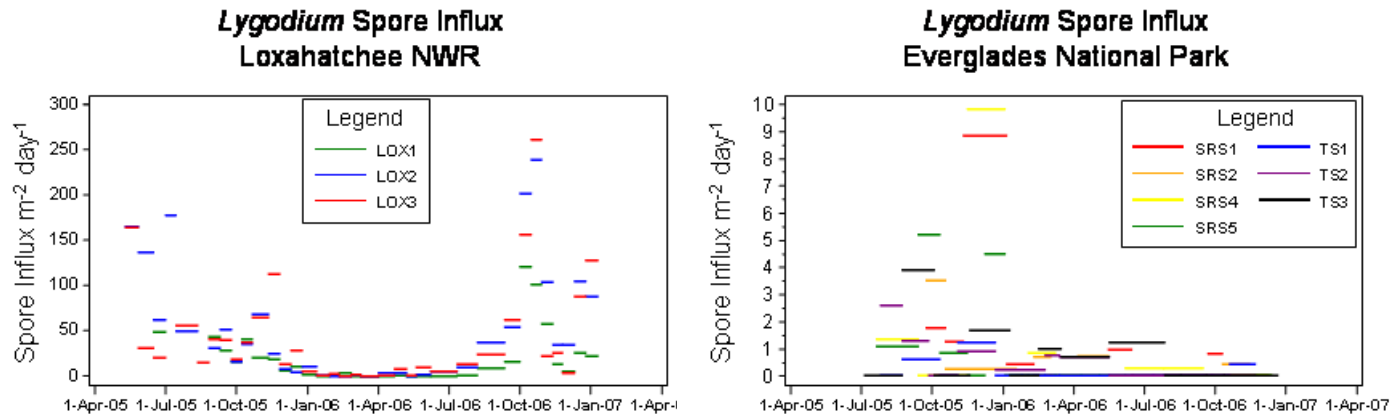
In both ecosystems, increased human activity and environmental disturbance have led to exotic plant invasions

Pantanal Exotic Species

Brachiaria subquadripara



Spore dispersal and simulated expansion of *Lygodium microphyllum*



(Philippi and Richards, 2007)

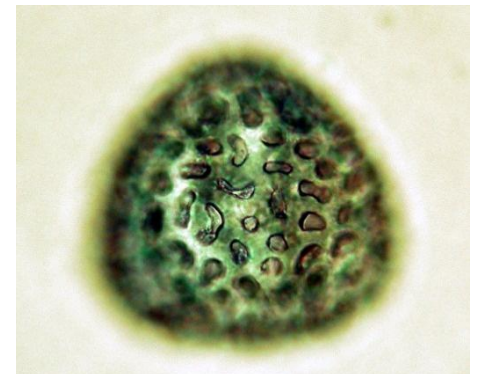
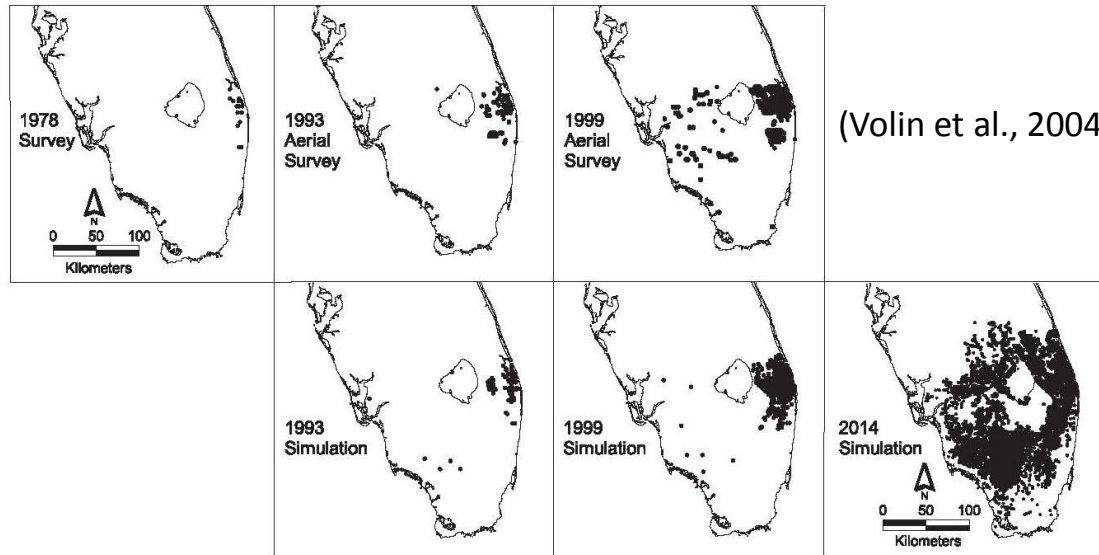


Figure 5 Actual and simulated spread of *L. microphyllum* across southern Florida from 1978 to 2014. Actual infestations are from a survey conducted in 1978 (Nauman and Austin, 1978) and from a series of aerial transects flown by the South Florida Water Management District every two years from 1993 through 1999. Aerial transects ran east to west from the Atlantic Ocean to the Gulf of Mexico and were spaced at 4.0 km intervals from central to southern Florida. Simulations shown are from independent model runs for 1978 through 1993, 1993 through 1999 and 1999 through 2014.

prospects for

collaborative research

Everglades

Pantanal

Thematics

The process of spread and retraction of populations x multi-year regime.

What lessons from the experience of research with Invasive exotic plant can use is to restore open savanna landscapes?



Everglades

Pantanal

Plants

1&2-sawgrass flowers, 3-Liatris and cabbage palm, 4-marlberry, 5-water lily and bladderwort, 6-pickerel weed, 7-horned bladderwort

Pott&Pott (1994)

