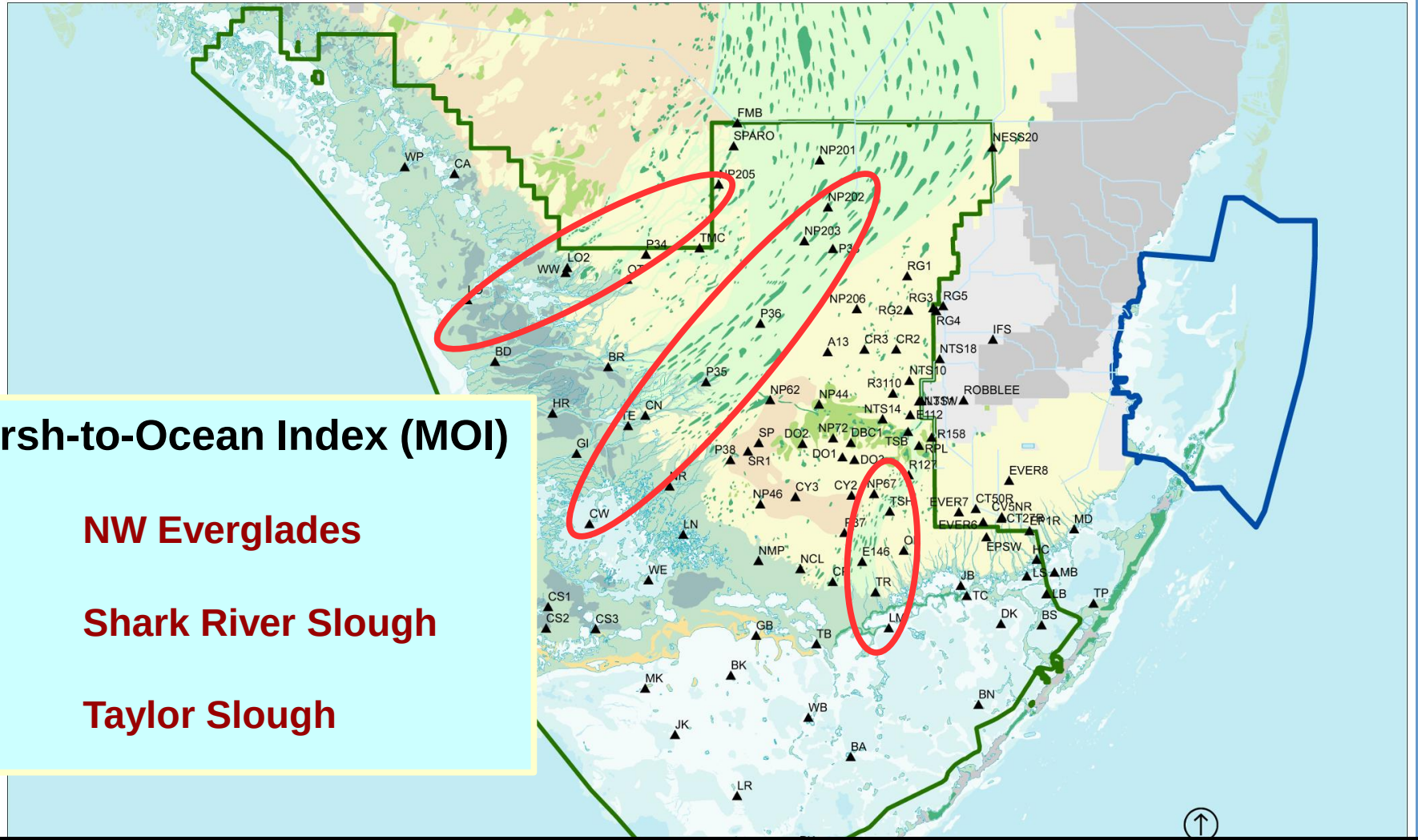


Marsh-to-Ocean Index (MOI)

NW Everglades

Shark River Slough

Taylor Slough

National Park Service
U.S. Department of the Interior

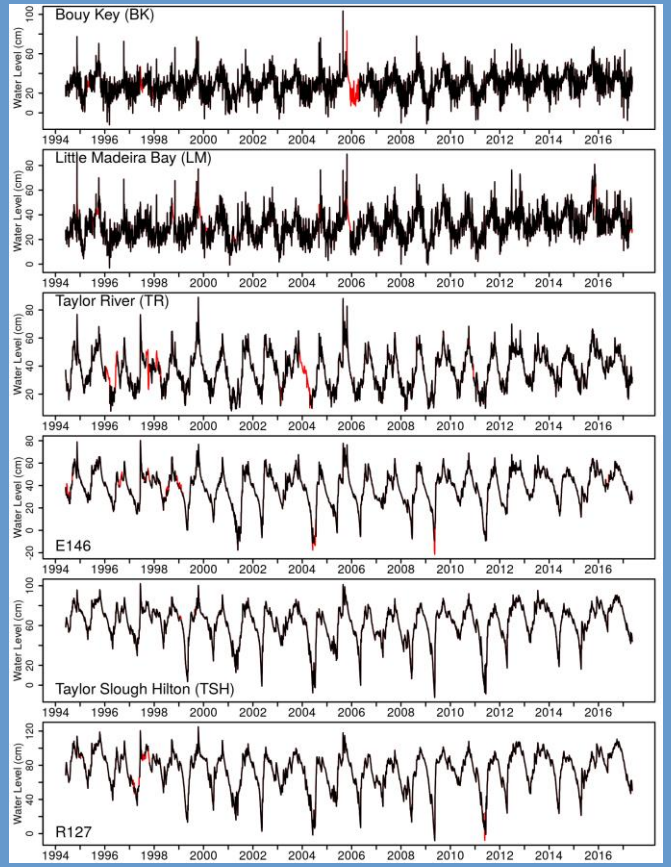
South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

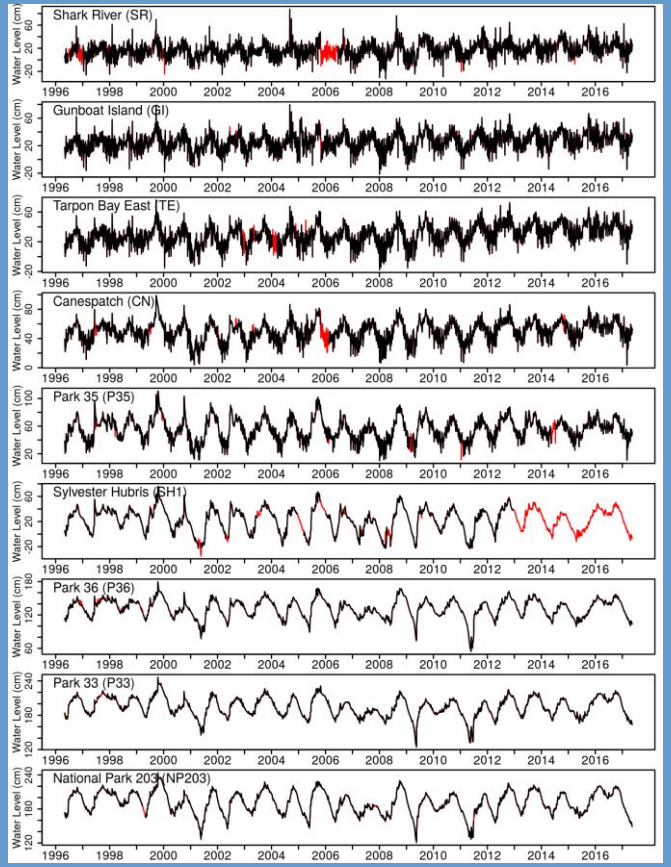
Physical Resource Branch

Raw Data – Daily Mean Water Level (black) : Reconstructed (red)

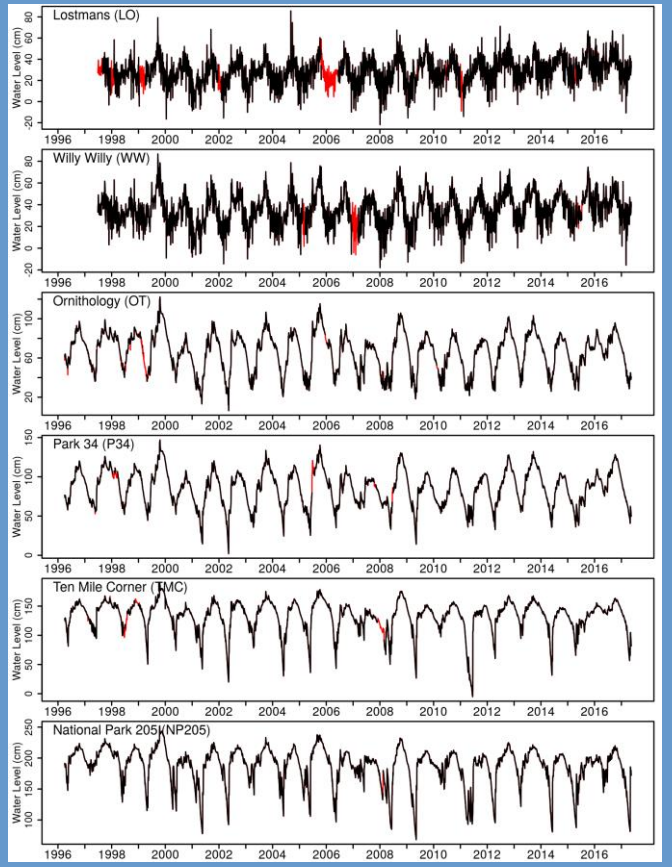
Taylor Slough



Shark River Slough



NW Everglades



National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

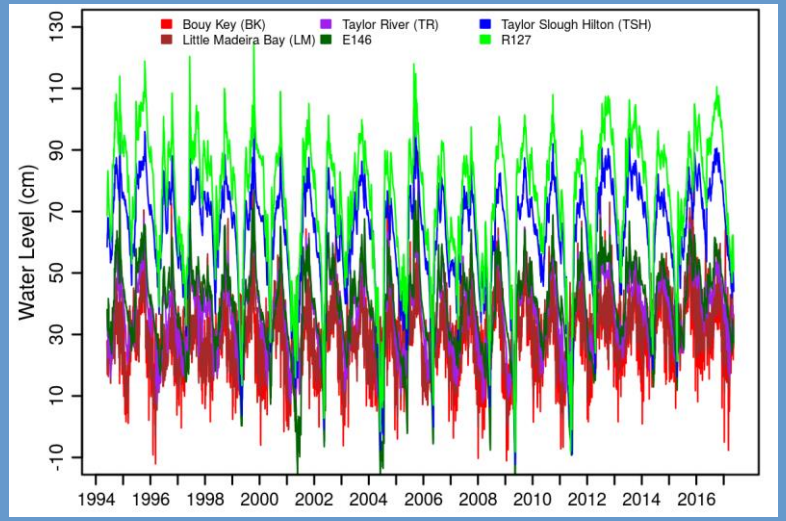
Physical Resource Branch

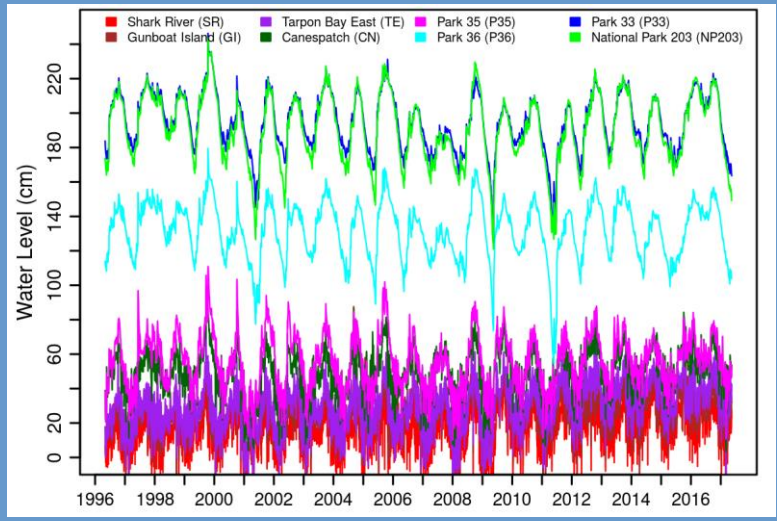
Raw Data – Daily mean water level

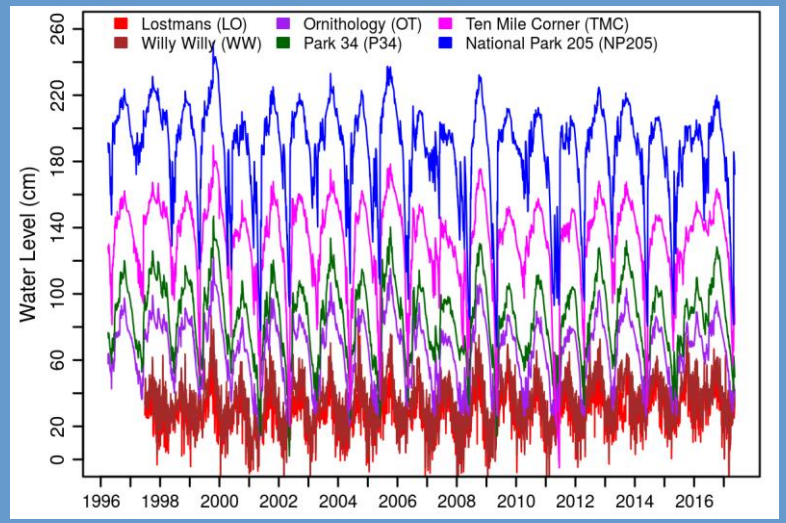
Taylor Slough

Shark River Slough

NW Everglades







National Park Service
U.S. Department of the Interior

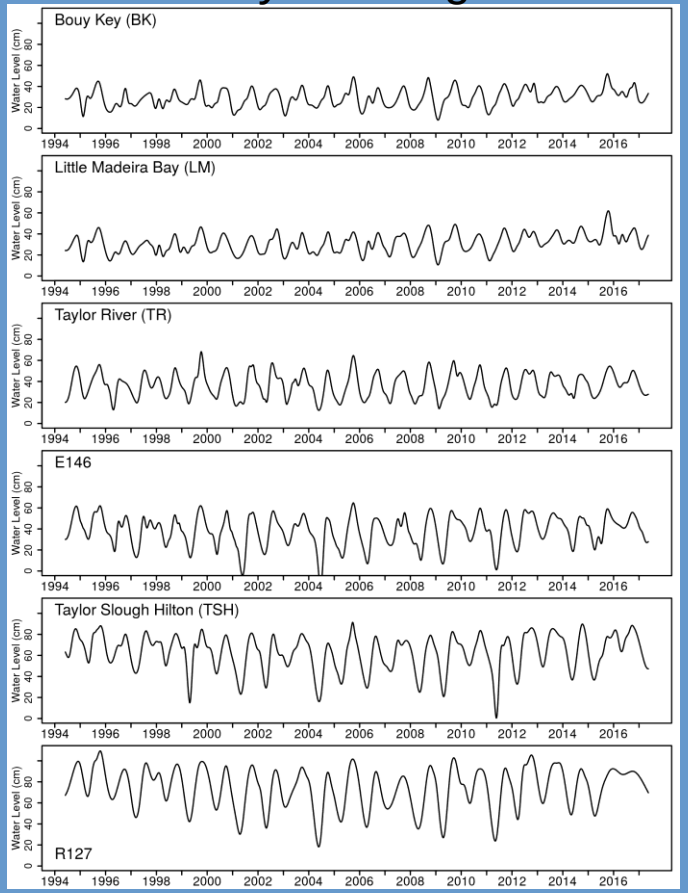
South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

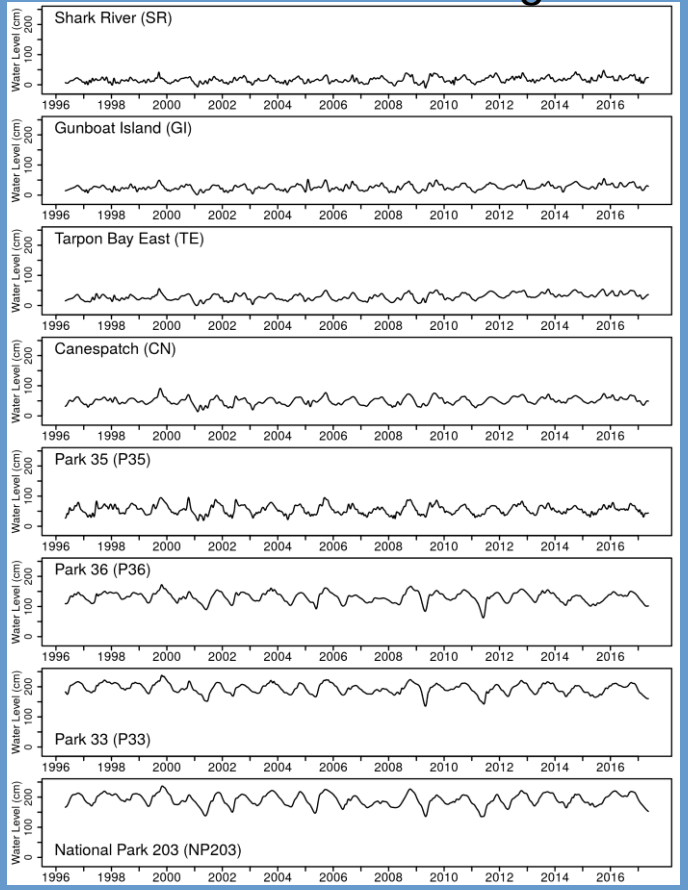
Physical Resource Branch

EMD : Accumulated Intrinsic Mode Functions (IMFs) : LPF

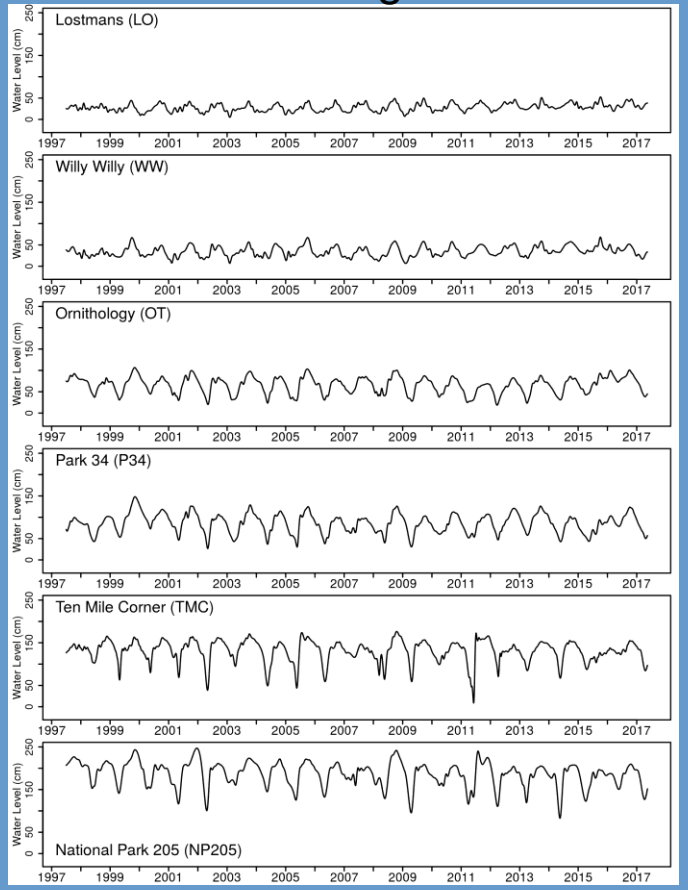
Taylor Slough



Shark River Slough



NW Everglades



National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch

MOI

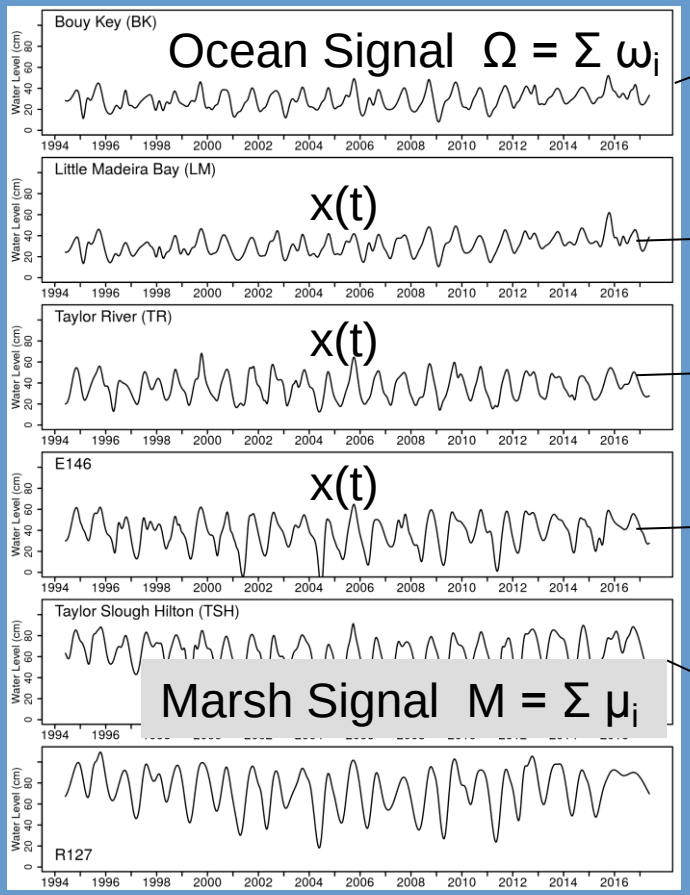
Weighted sum of Ocean and Marsh IMF's to replicate observed intermmediate hydrodynamics.

$$W(t) = \sum_{i=L}^{i=H} \omega_i \, IMF_{\Omega_i} + \mu_i \, IMF_{M_i}$$

$$\mathrm{MOI} = \frac{M - \Omega}{N}$$

$$\Omega = \sum \omega_i,$$

$$M = \sum \mu_i$$



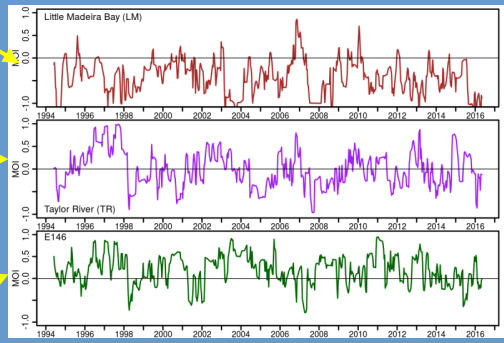
[ω_L , ω_{L+1} , … , ω_H]

Φ= var[W(t) – x(t)]

ΔΦ

ΔΦ

ΔΦ



[μ_L , μ_{L+1} , …. , μ_H]

National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

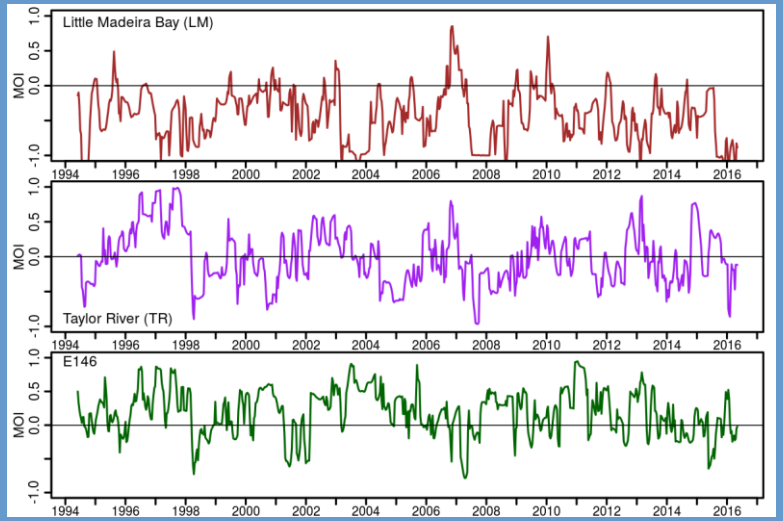
Physical Resource Branch

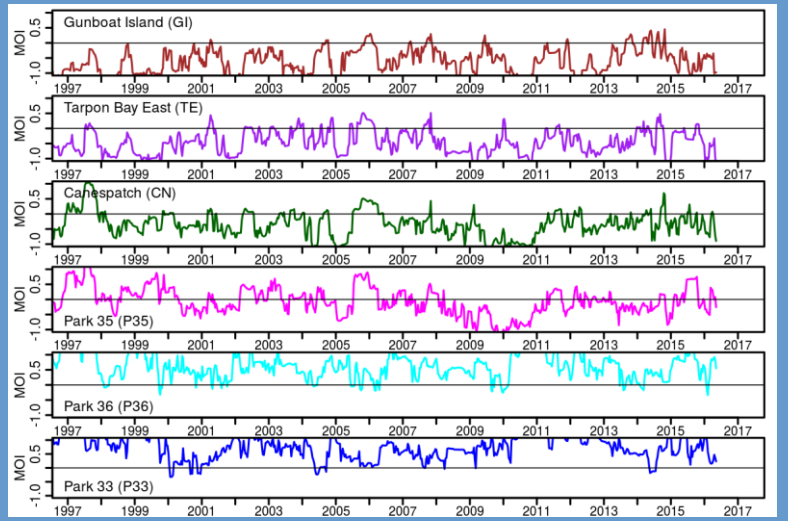
MOI

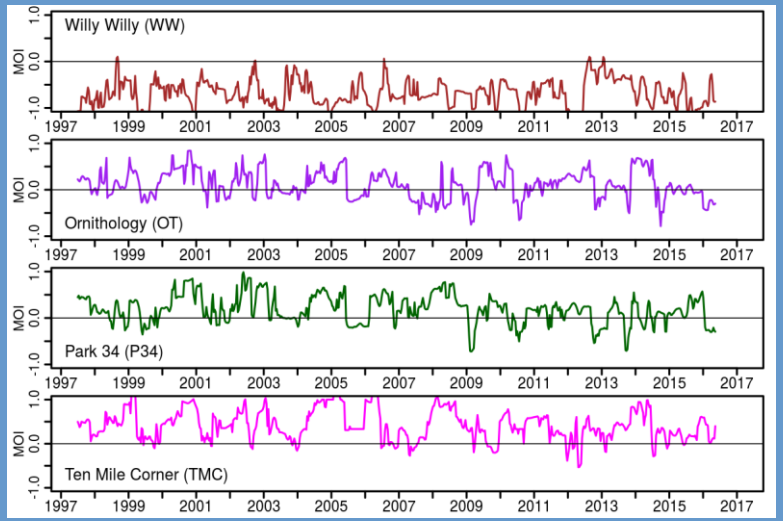
Taylor Slough

Shark River Slough

NW Everglades







National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

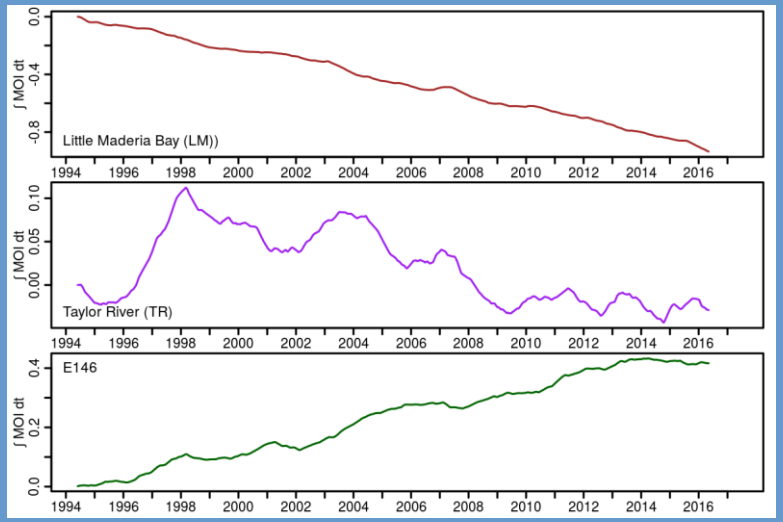
Physical Resource Branch

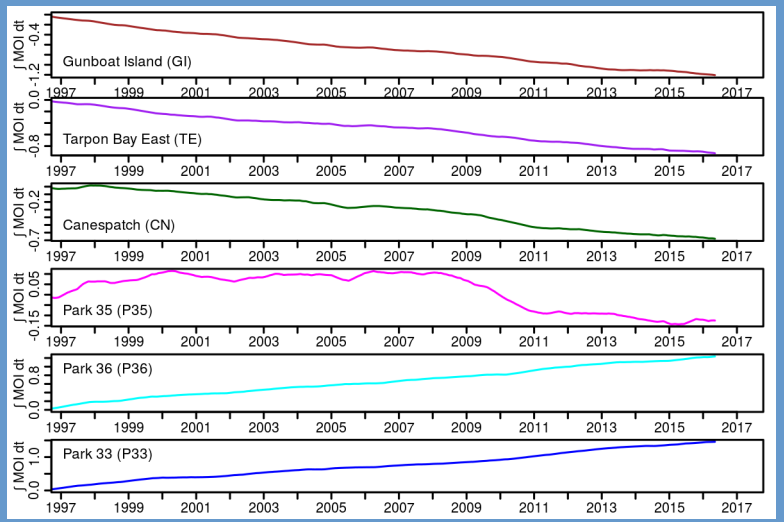
$$\int_0^T MOI(t)dt$$

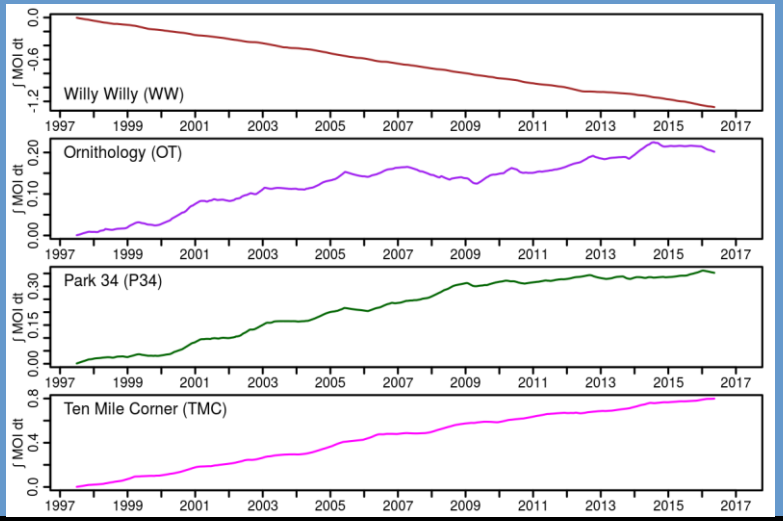
Taylor Slough

Shark River Slough

NW Everglades







National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

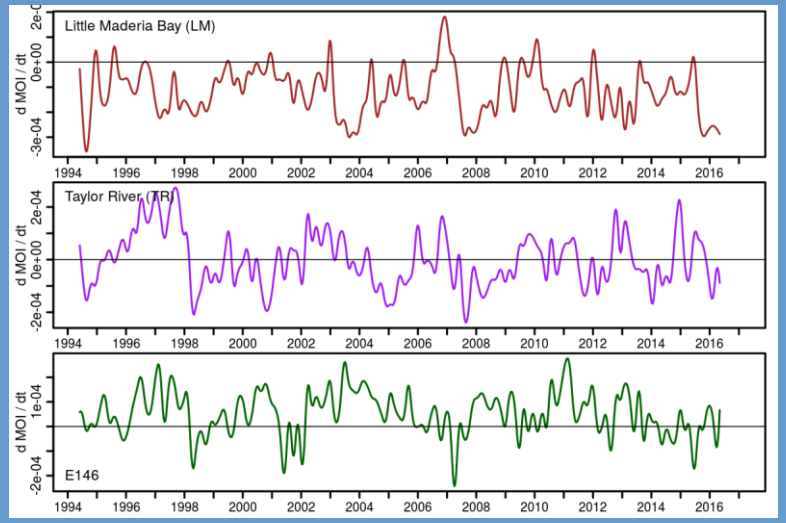
Physical Resource Branch

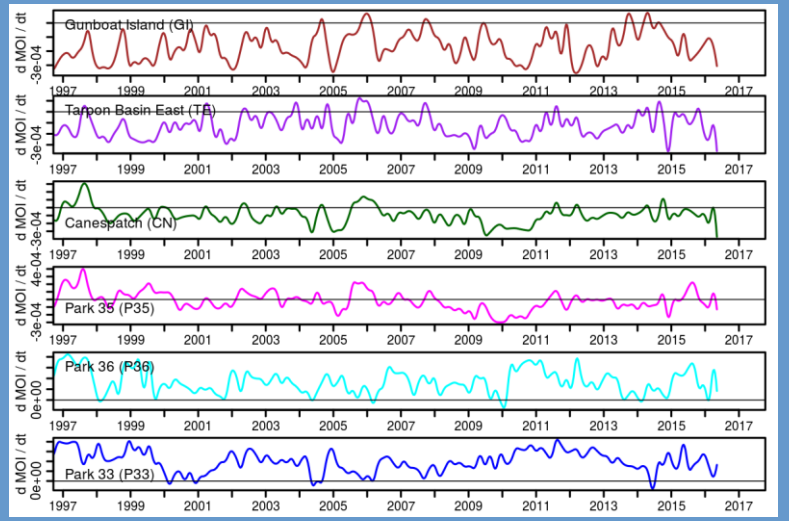
$$\frac{d}{dt}MOI(t)$$

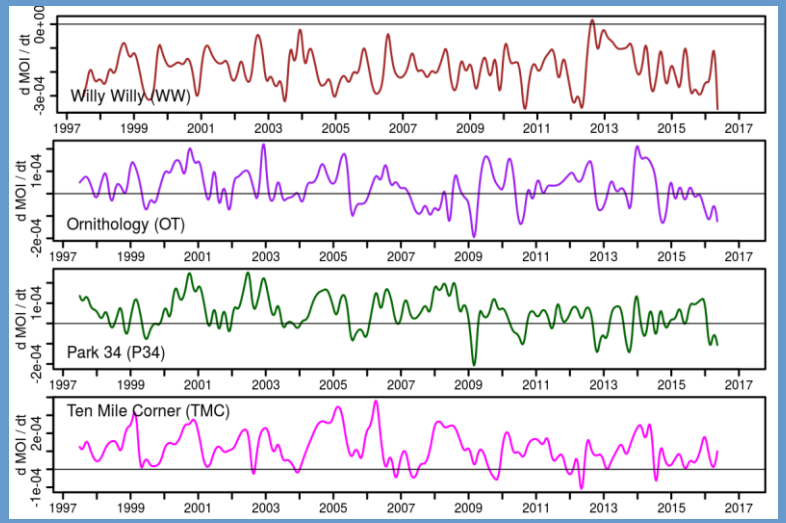
Taylor Slough

Shark River Slough

NW Everglades







National Park Service
U.S. Department of the Interior

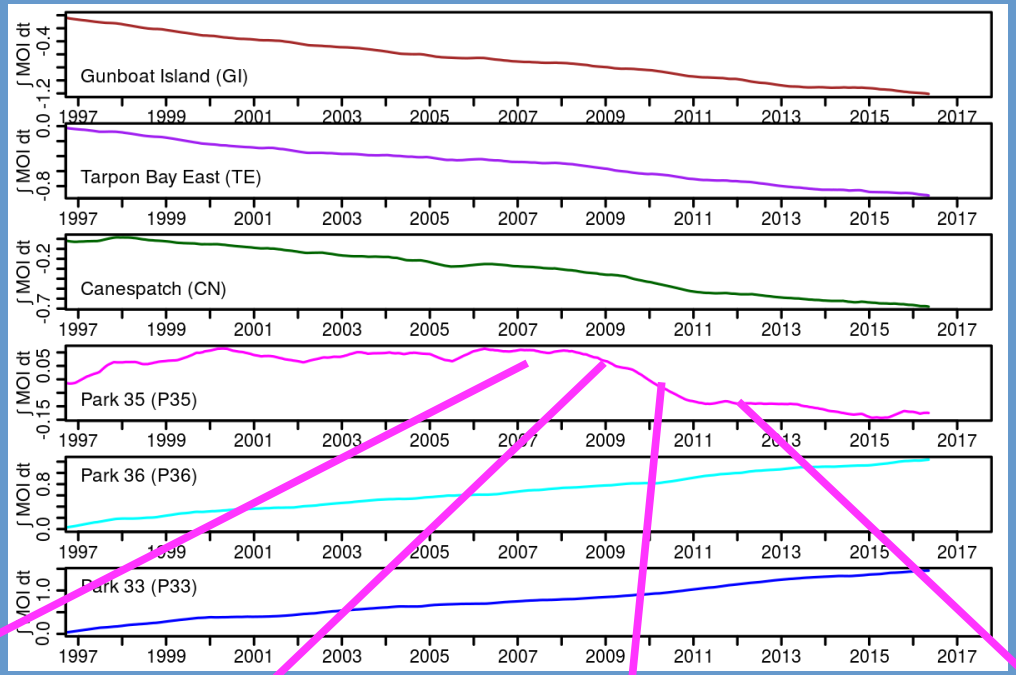
South Florida Natural Resouces Center
Everglades National Park

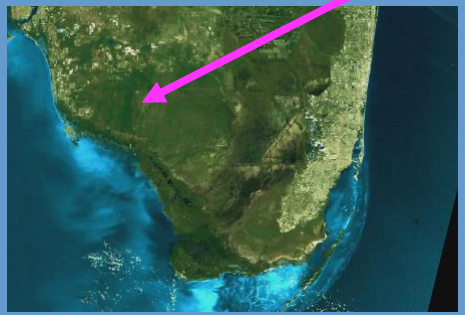
Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

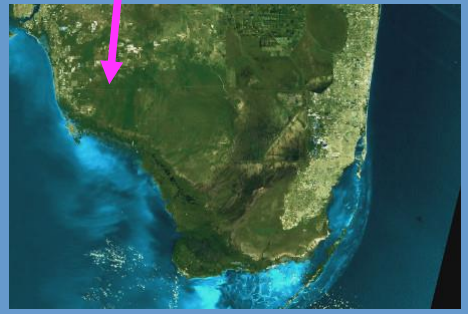
Physical Resource Branch

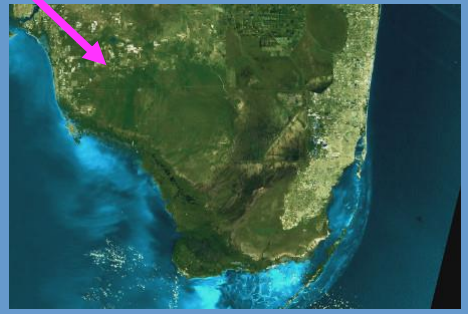
Objective:

Quantify & Correlate MOI temporal dynamics with ecotone dynamics evidenced in remote sensing









National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

The Everglades National Park and Big Cypress National Preserve Vegetation Mapping Project

Interim Report–Southeast Saline Everglades (Region 2), Everglades National Park

Natural Resource Report NPS/SFCN/NRR—2017/1494

Pablo L. Ruiz,[1] Helena C. Giannini,[1] Michelle C. Prats,[1] Craig P. Perry,[1] Michael A. Foguer,[1] Alejandro Arteaga Garcia,[2] Robert B. Shamblin,[1] Kevin R. T. Whelan,[1] Mary-Joe Hernandez[2]

[1]South Florida Caribbean Network Inventory and Monitoring Program
18001 Old Cutler Road, Suite 419
Palmetto Bay, Florida 33157

[2]Florida International University
11200 SW 8th Street
Miami, Florida 33199

National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch

Vegetation Code Schema 7 Tables 201 Elements (Columns)

Level 1 : n = 8	**A**	**F**	**E**	**C**	**S**	**M**	**W**	**O**
	Aquatic	Forest	Exotic	Scrub	Shrub	Marsh	Woodland	Other

Level 2 : n = 15	AF	AM	FU	FW	Es	CW	CU	SU	SW	MF	MS	WU	WW	OA	ON

Level 3 : n = 26	FH	WM	WS	WUH	SM	SS	SUC	SUH	CM	CS	CUW	MSG
	MSS	MFB	MFG	MFGP	MFH	MFO	ONM	ONS	ONT	ONW	OAT	

Level 4 : n = 45	WMa WMc WMX WSt SMa SMc SMl SMr SMX SSB SSBT SSy FMa FMc FMl FMr FMX FSw FSB FSBT FSt FHC FHS OATr CUWGP CSt CSh CSBT CSB CMX CMr CMl CMc CMb CMa MFHi MFGPm MFGPc MFGX MFGt MFGr MFGe MFGc MFBs MSGj
Level 5 : n = 55	SMXac SMXal SMXar SMXcl SMXcr SMXlr SMXry SMXX CMaG CMaO CMaS CMaD CMcG CMcS CMlS CMrD CMrG CMrO CMXac CMXal CMXar CMXcl CMXcr CMXX CSBG CShG CStG CStGP MFGcT MFGcS FMXac FMXal FMXar FMXcl FMXcr FMXlr FMXX FStD FStS FHCc FHCg FHCt FHCD WMaG WMaO WMaS WMcG WMcS WMXac WMXal WMXar WStG CSBTO CSBTG CUWGPc
Level 6 : n = 45	CMXcrO CMXXD MFGcSS CMXcrG CMXXS CMXXO CMXXG CSBGe CSBGc CSBTGe CSBTGc CShGc CStGPc CStGe CStGc MFGcSD MFGcTD CMXclS CMXcrD CMcGf CMcGc CMrGc CMrGe CMrGj CMrGt CMXacD WStGc WMXarS WMXarO WMXarG WMXalS WMXacS WMXacO WMXacG CMaGc CMXacS CMXacO CMXacG CMXalD CMXalS CMXalO CMXarG CMXarO CMXarS CMXarD CMXcrS
Level 7 : n = 7	CMXXGe CStGcS CMXarGj CMXarGe CMXcrGj CMXcrGe CMXcrGc

National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

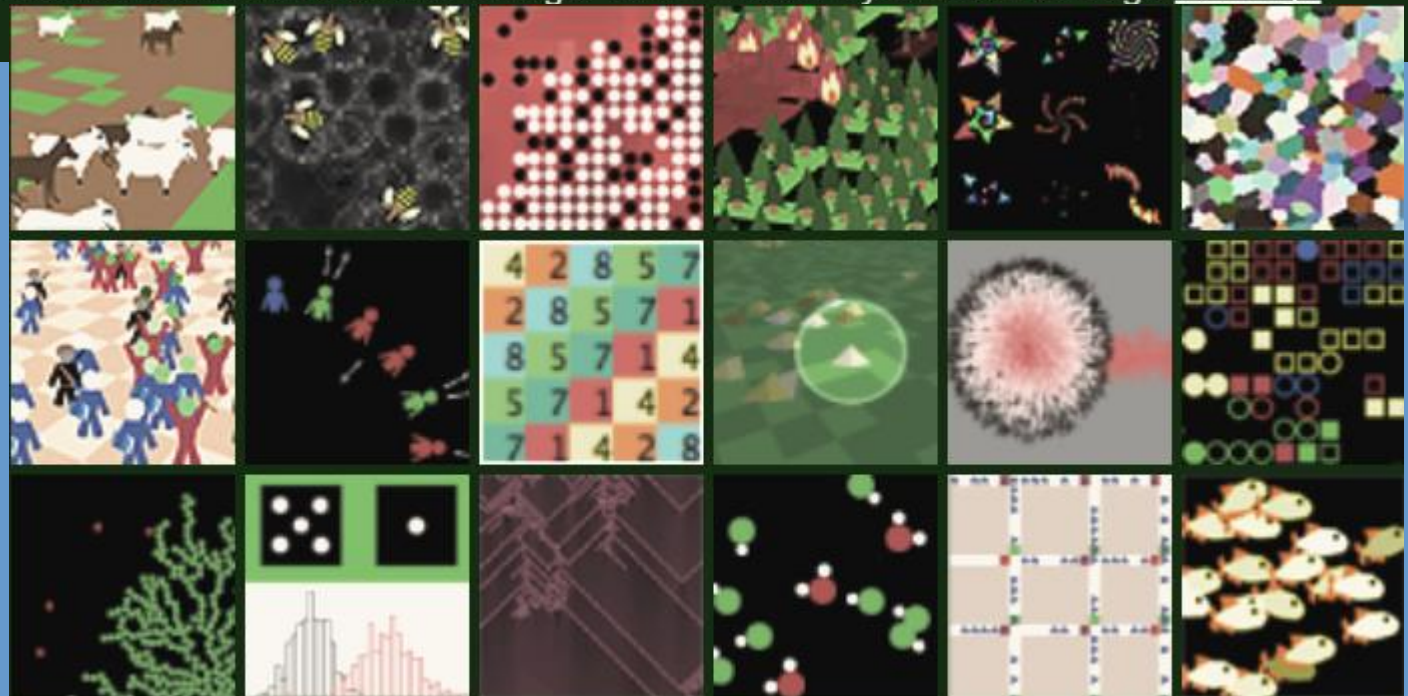
Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch

NetLogo

Home
Download
Help
Resources
Extensions

NetLogo is a multi-agent programmable modeling environment. It is used by many tens of thousands of students, teachers and researchers worldwide. It also powers HubNet participatory simulations. It is authored by Uri Wilensky and developed at the CCL. You can download it free of charge. You can also try it online through NetLogo Web.



File Edit Tools Zoom Tabs Help

Interface | Info | Code

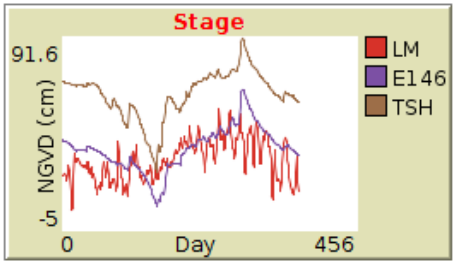
Edit Delete Add Button faster ticks: 366 view updates continuous Settings...

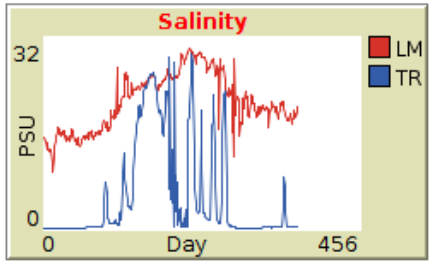
setup

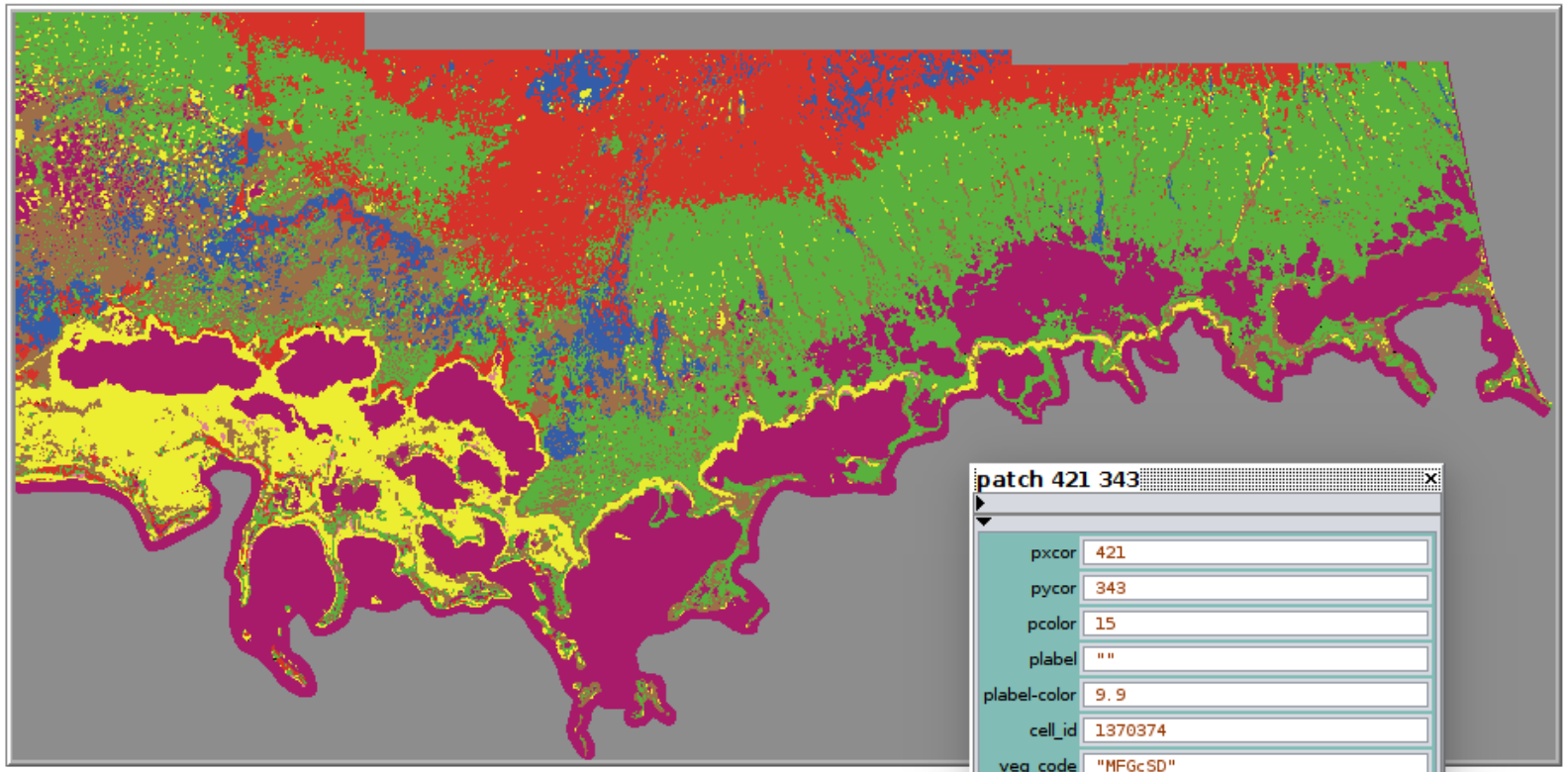
go

start-date 2000-01-01

end-date 2001-12-31







patch 421 343

pxcor	421
pycor	343
pcolor	15
plabel	""
plabel-color	9.9
cell_id	1370374
veg_code	"MFGcSD"
name	"Short Sawgrass Marsh-Dense"
elevation	0.847665
stage	0

Command Center

Clear

```
Loading GIS shapefile...
 "Loading patches..."Done
```

observer>

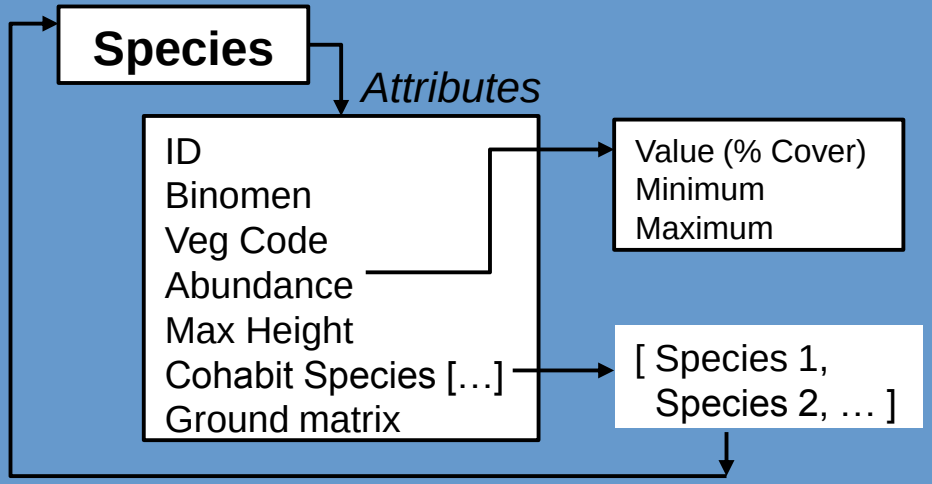
Vegetation Code Implementation

Each GIS Grid Cell has one of 201 Vegetation Codes Assigned.

Note: Redudancy Exists in Veg Code Classification

Cell_ID MFB	Cell_ID FMXar	Cell_ID CNXcrD	Cell_ID MFGPc

Proposed Species-centric Data Model



Proposed Species-centric Implementation

Each GIS Grid Cell has one or more of 27 **Species** data objects assigned.

Cell_ID Mangrove	Cell_ID Sawgrass Spikerush	Cell_ID Buttonwood Poisonwood

National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch

27 Species : 214 Vegetation Codes

Species	N
Black Mangrove	58
Buttonwood	32
Red Mangrove	30
White Mangrove	20
Cypress	13
Sawgrass	11
Red Bay	7
Poisonwood	5
Gumbo Limbo	5
Sweet Bay	4
Pond Apple	4
Mahogany	3
Buttonbush	3
Fan Palm	2

Species	N
Swamp Bay	2
Black Rush	2
Monring Glory	2
Sea Grape	2
Oxeye	1
Paurotis Palm	1
Arrowhead	1
Spikerush	1
Saltwort	1
Muhly Grass	1
Beakrush	1
Cattail	1
Cocoplum	1

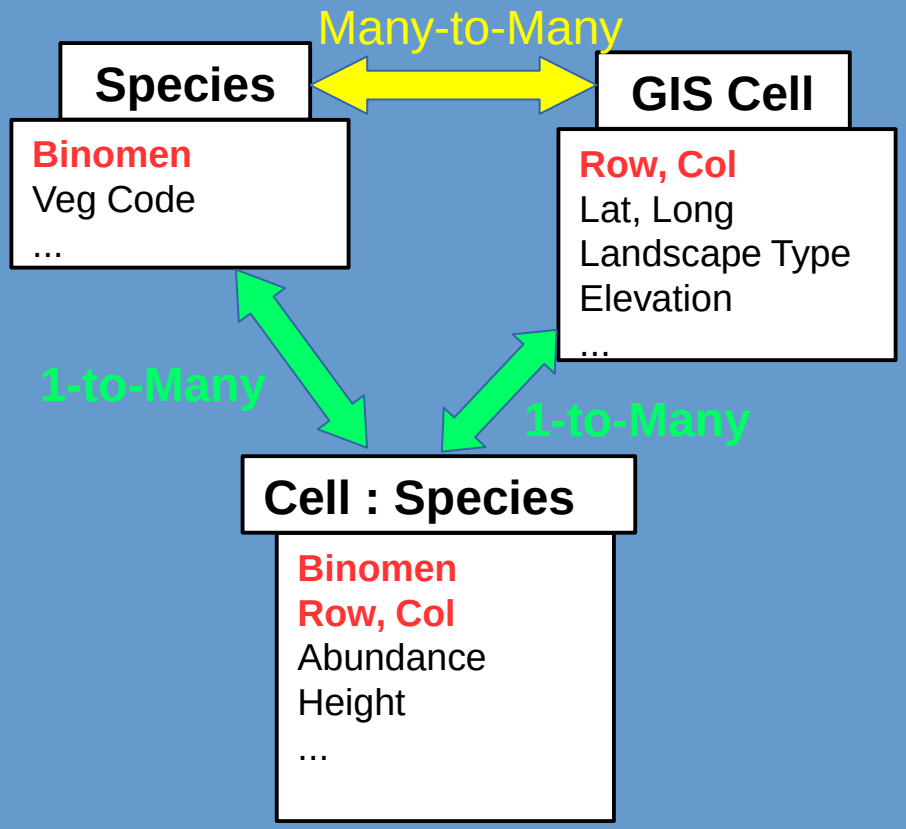
National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

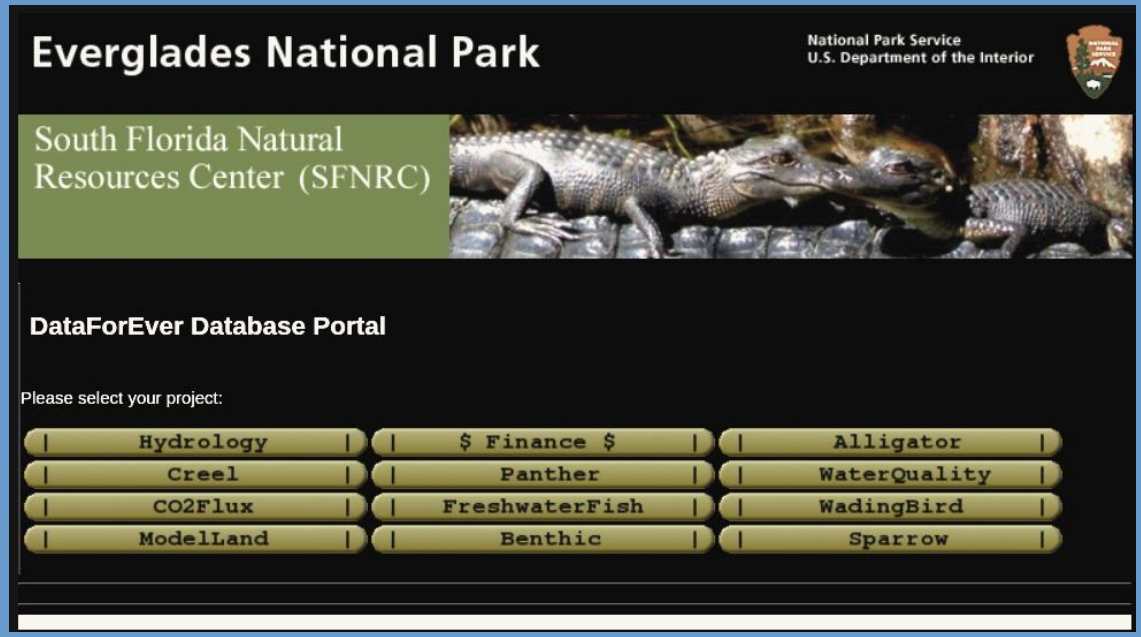
Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch

Relational Database Model



Leverage Relational Database implementation into analytical capability

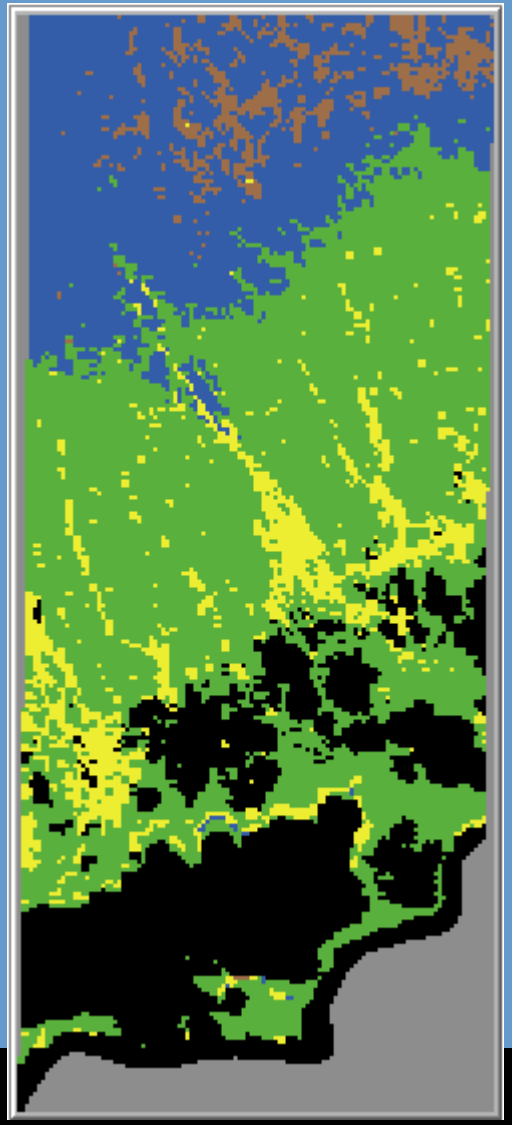


National Park Service
U.S. Department of the Interior

South Florida Natural Resouces Center
Everglades National Park

Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

Physical Resource Branch



South Florida Natural Resouces Center
Everglades National Park

Species-centric Agents

```
;-------------------------------------------------------------------------
to set-color-lists
;-------------------------------------------------------------------------
  ; setup patch & turtle color mapping to species
  set green_list  [ "Black Mangrove" "Red Mangrove" "White Mangrove" ]
  set blue_list   [ "Fan Palm" "Swamp Bay" "Arrowhead" "Sawgrass"
                    "Spikerush" "Black Rush" "Muhly Grass" "Beakrush"
                    "Cattail" "Morning Glory" ]
  set yellow_list [ "Buttonwood" "Buttonbush" "Seaside Oxeye" "Paurotis Palm"
                    "Saltwort" "Sea Grape" ]
  set red_list    [ "Mahogany" "Hardwood Hammock" "Swamp Woodland"
                    "Hardwood Woodland" ]
  set brown_list  [ "Cypress" "Cocoplum" "Gumbo Limbo" "Red Bay" "Sweet Bay"
                    "Pond Apple" "Poisonwood" ]
  set pink_list   [ "Mixed Shrub" "Broadleaf Marsh" "Swamp Shrubland" ]
  set magenta_list[ "Open" ]
end
```

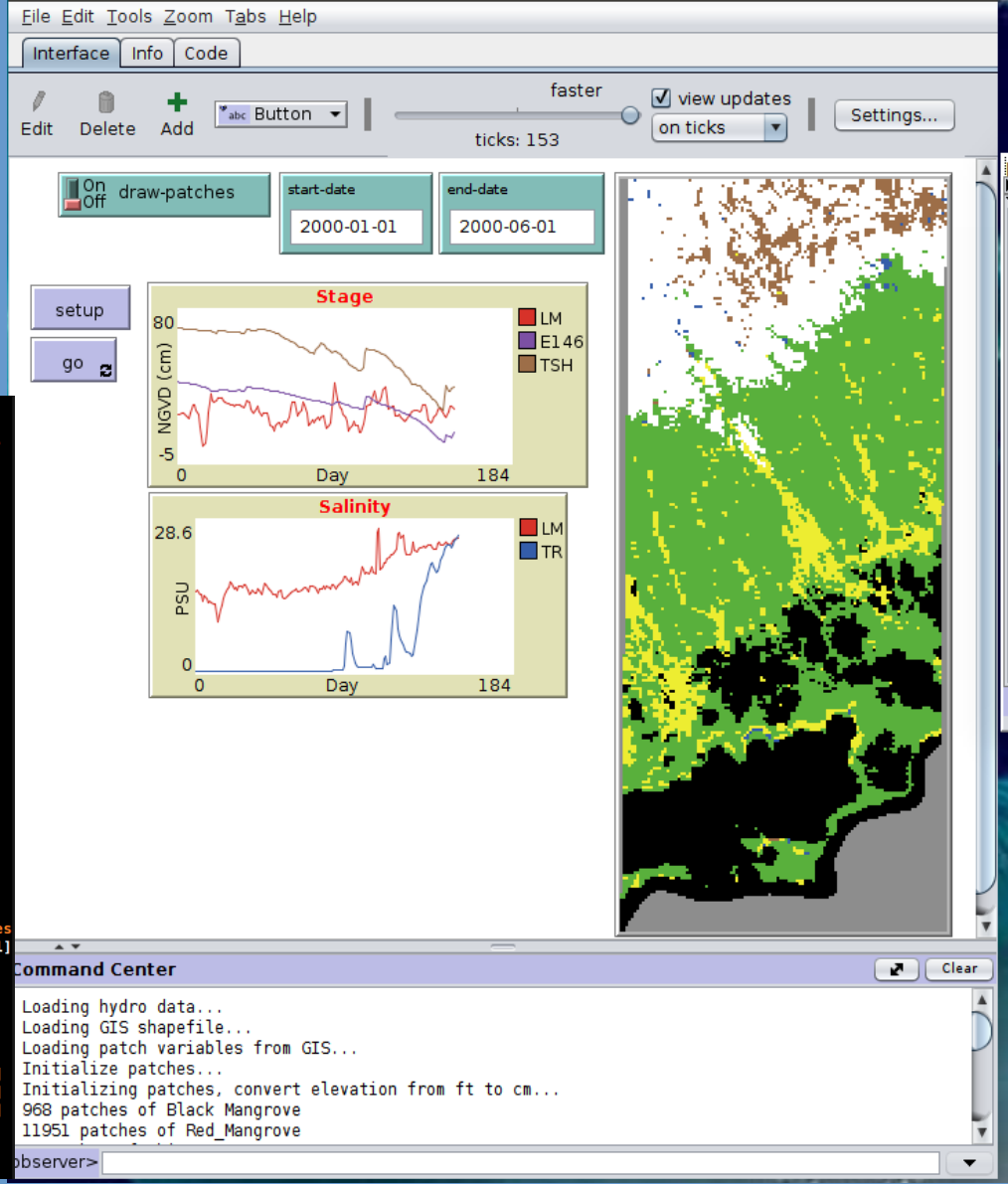
Jed Redwine, Joseph Park & Kevin Kotun Jan 19, 2018

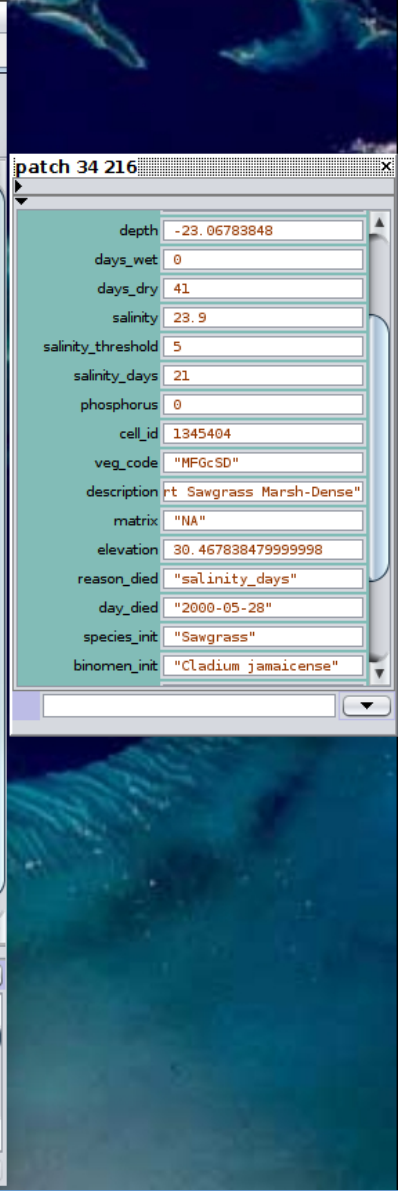
Physical Resource Branch

Objective:

Define Species-centric agent behaviors

```
;-------------------------------------------------------------------------
; Sawgrass – Cladium jamaicense and Cypress - Taxodium distichum
; Occurs in areas with water continuously aboveground for 6-11 months per year.
; Maximum water depths below 3 ft.
; Cannot survive more than 3 weeks of porewater salinity above 5 psu
; Fire adapted species, resprouts quickly, return interval 2-12 years.
;-------------------------------------------------------------------------
  ask Sawgrass_patches [

    let plants sawgrass-here ; plants agentset of sawgrass on this patch

    if count plants > 0 [
      ; Get patch water depth
      set depth TaylorSlough.stage stage_station - elevation

      ; Accumulate and reset the patch hydroperiod variables
      ifelse depth > 0 [ set days_wet days_wet + 1  set days_dry 0 ]
                       [ set days_dry days_dry + 1  set days_wet 0 ]

      ; Guassian of days_dry to determine death
      ; The range is [0, 365] days, value is N( days_dry, 15 )
      let days_dry_ min ( list 365
                          max ( list 0 random-normal days_dry 15 ) )

      ; Get patch salinity
      set salinity Salinity.psu salinity_station

      ; Accumulate or reset days with salinity above salinity threshold
      ; Note that patch salinity_threshold was set to the initial turtle
      ; salinity_max when the sawgrass was sprouted in sprout-turtles-on-patches
      ifelse salinity >= salinity_threshold[set salinity_days salinity_days + 1]
                                           [set salinity_days 0 ]

      ; Get copy of turtle-context variable salinity_max_days
      let salinity_max_days_ 0
      ask one-of plants [ set salinity_max_days_ salinity_max_days ]

      if depth > 90                        [ necrosis plants "depth > 90"    ]
      if days_dry_ > 180                   [ necrosis plants "days_dry > 180"]
      if salinity_days > salinity_max_days_ [ necrosis plants "salinity_days" ]
    ]
  ]
end
```





Objectives

I. MOI / Landsat synthesis & analysis.
J Park J Redwine …. …. ….

II. Develop & Define Species and Patch agent behaviors.
J Park J Redwine …. …. ….

III. Review Everglades Landscape Vegetation Succession (ELVeS) model for probabilistic agent behaviors.
J Park J Redwine …. …. ….

IV. Collaborate on extension and development of MOI/Landsat dynamics into temporal ‘snapshot’ vegetation maps for ABM ‘calibration’.
J Park J Redwine …. …. ….

V. Advocate Vegetation Map ingestion into Relational DB (Data4EVER).