The Development Process and Methods for the Everglades Report Card

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A general overview

Ecosystem health assessments have become more common in recent years, and report cards are being produced by a variety of groups from small, community–based organizations to large partnerships. Ecological report cards provide a numeric score and are considered a public friendly way to provide a timely and geographically detailed assessment of ecosystems.

As environmental monitoring has been conducted in the Florida Everglades for many years and there is a need to communicate the data collected. Synthesizing and integrating the data into a document that is accessible to the general public and specific groups throughout the Everglades informs the community of the health of their local environment. However, not all the information that is generated by this process can fit into a public-friendly report card. The following pages describe in detail the methods and scoring procedures used to develop the Everglades report card.

A number of steps were taken in the development of the report card. The first preliminary meeting in the form of a webinar was held in February 2017 with RECOVER (REstoration COordination & VERification) executive committee members from the South Florida Water Management District and the US Army Corps of Engineers.

The first full stakeholder workshop was conducted in March 13-14 2017 at the Water Management District in West Palm Beach, with members of RECOVER including the regional coordinators of the four Everglades regions. The main goals of the March workshop were to discuss content and organization of the 2019 System Status Report, preview key findings, themes, and messages, introduce the report card format, discuss report card scoring, and mock-up a draft of the report card. A newsletter was developed summarizing the results of the workshop.

In August 2017, workshops occurred for each region within the Everglades. These meetings brought together the regional coordinators, principle investigators, and scientists from different disciplines within each region. These workshops helped to further define the values, threats, indicators, data sources, and stories for the report card. Four newsletters were developed summarizing the results of these workshops.

After the workshops, numerous conference calls occurred to finalize the indicators, establish thresholds, review data analysis and report card scores, and design and produce content for the report card.

A workshop on May 22, 2018 occurred to review the final indicators, data, thresholds, scoring, and draft report card and website. The presentation of the draft report card and report card website was at the US Fish & Wildlife Service Office in Vero Beach, Florida. This meeting went over the final edits for the indicators and report card scoring.

The report card provides a transparent, timely, and geographically detailed assessment of the overall health of the Everglades and each of its four regions: the Northern Estuaries, Lake Okeechobee, the Greater Everglades, and the Southern Coastal Systems using data from 2012-2017. In addition to the scores, background information about key features, values, and threats in the Everglades, discussion about the main results, and details about what restoration projects are occurring in the Everglades were included in the report card document. In the years that follow, additional indicators can be added to the analysis, as well as refinement of thresholds based on further research.

Contents

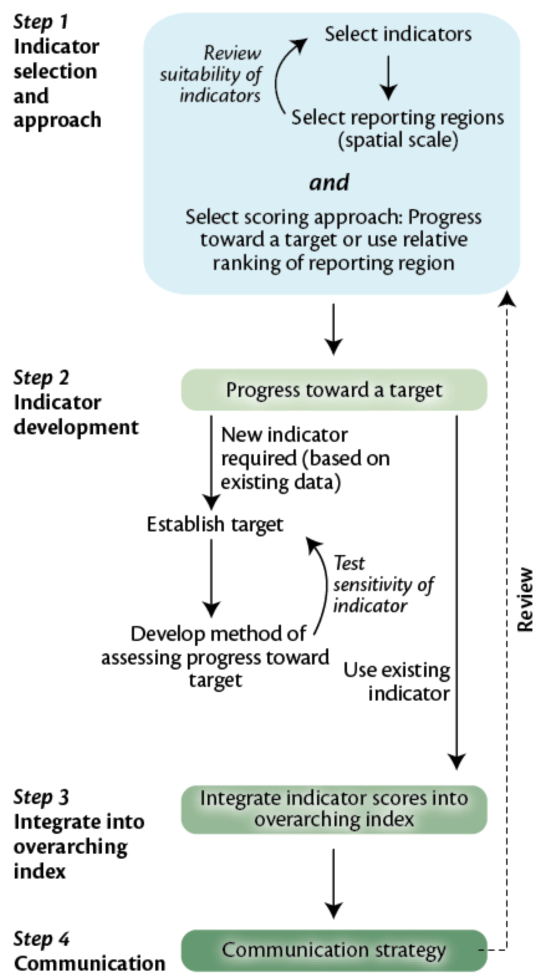
Introduction

Ecological report cards are considered a public friendly way to provide a timely and geographically detailed assessment of ecosystems. Report cards provide a numeric score, allowing for quick and understandable results to a broad audience. One key aspect of report cards is that they integrate and synthesize diverse data sources and types. Over the last ten years, report cards have gained popularity as a communication tool in the United States (Chesapeake Bay, Gulf of Mexico, Mississippi River, Long Island Sound, Willamette River) as well as many international areas (Great Barrier Reef, Australia; Chilika Lake, India; Orinoco River, Colombia; Guanabara Bay, Brazil).

Existing data collected over many years provides an excellent platform and material to develop a report card that acts to synthesize, interpret, and disseminate this information about the region. Ultimately, the partners of RECOVER, US Army Corps of Engineers, and the South Florida Water Management District plan to use this iterative process of creating report cards to improve community and management awareness and understanding of the status of health of the Everglades in a succinct format that will serve as an executive summary of the System Status Report which is released every five years. The primary objectives of this project are to collate and compile data, review relevant indicators, and synthesize information to effectively report the environmental status of the Florida Everglades.

Determining indicators

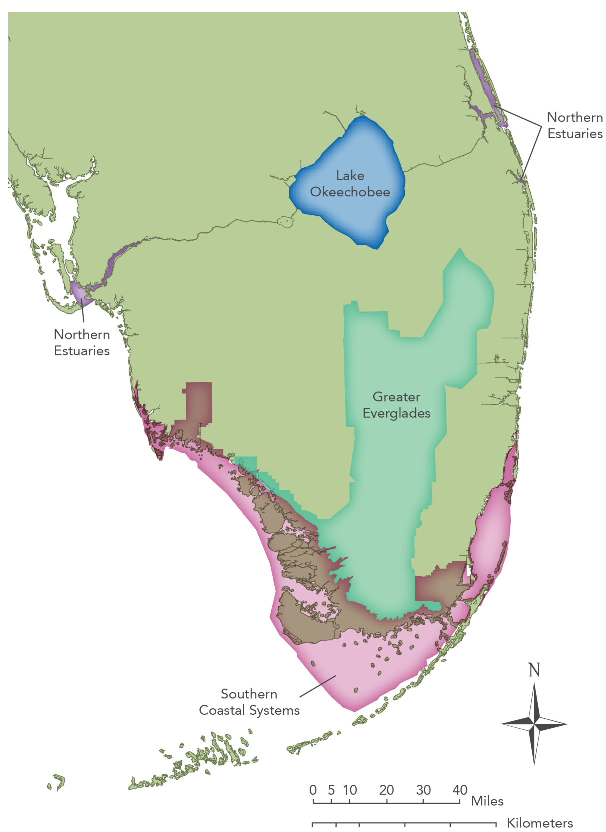
The figure at right illustrates the process that occurs when producing a report card. There are four main steps: 1) Indicator selection and approach, which includes assessing currently available data as well as the "ideal" datasets, 2) Indicator development, which includes developing targets or thresholds (discussed more in the next section) for each indicator, 3) Integrating indicators into an overarching index, and 4) Communicating the results through a report card product. Fundamentally, all report cards should be based on indicators and indices that are scientifically defendable, preferably peer-reviewed, and transparent. The data and methods underlying the report card should be understandable and clear to all audiences, should they want to drill down from the overall score to individual metrics that make up indicators or indices.



For the Everglades report card, several workshops with the regional coordinators and principal investigators were convened throughout the project, and one of the main goals of the workshops was to determine potential indicators for the report card (image at right). The workshop started with a full list of potential indicators including indicators of water quality, fisheries, wildlife, marine mammals, human health, toxic contaminants, and others. As the discussions continued, an ideal list of indicators that could be included was collated. From there, the spatial and temporal resolutions of the indicators were determined to ensure that there was sufficient amount, coverage, and frequency of data for use in the analysis. Other indicators not currently in the report card can be incorporated in the future with additional research and supported monitoring programs.

Region and sub-region determination

Regions and sub-region areas are usually determined based on geographic features (such as geology or land use) or hydrology (such as drainage basin size, water circulation patterns, water flow). For example, if there is an upstream portion, a mixing portion, and a "receiving waters" portion, those could be the three sub-regions. Remember that all sub-regions need to have enough sampling sites to be scientifically rigorous and provide consistent analysis.
The regions for the Everglades Report Card were already established by RECOVER and their Monitoring and Assessment Plan (MAP). There are four regions, the Northern Estuaries, Lake Okeechobee, the Greater Everglades, and the Southern Coastal Systems. Out of these four regions, two of them have no sub-regions; Lake Okeechobee and the Greater Everglades. The other two regions each have three sub-regions. The sub-regions for the Northern Estuaries are the Caloosahatchee River Estuary, the Loxahatchee River Estuary, and the St.



Lucie Estuary/Southern Indian River Lagoon. The sub-regions for the Southern Coastal Systems are Biscayne Bay, Florida Bay, and the Southwest Coast. All of these sub-regions were already determined prior to the project. The only change that was made was the combination of the Upper Southwest Coast and the Lower Southwest Coast into one region, the Southwest Coast, as there were not enough indicators to keep these areas separated.

Indicators

The indicators in this report card help answer the question "How healthy are the Everglades?" Each indicator measures a different parameter of the environment that affects organisms, or the organisms themselves that live in the ecosystems of the region. The report card compares 26 indicators to scientifically derived thresholds or goals. Each region has indicators that are relevant to that area (Table 1). For each region, the indicators are combined into an Overall Health Index, which is presented as a percent score. The four region scores are then combined into the overall Everglades Health Score. For indicator relevance visit evergladesecohealth.org.

Table 1: Indicators

Region	Indicators
Northern Estuaries	benthic infauna, chlorophyll *a*, oysters, salinity, submerged aquatic vegetation
Lake Okeechobee	chlorophyll *a*, emergent aquatic vegetation, fish, lake stage, submerged aquatic vegetation, wading bird nesting interval, wading bird nesting proportion, water clarity
Greater Everglades	alligators, invasive reptiles, marl prairie, nonnative fish, prey abundance, prey availability, ridge & slough, tree Islands, wading birds
Southern Coastal Systems	alligators, chlorophyll *a*, crocodiles, fish, goldspotted killifish, gulf pipefish, prey community, roseate spoonbill nesting, salinity, spotted seatrout, submerged aquatic vegetation

Indicator thresholds and scoring

Once the indicators were identified, targets or thresholds for each indicator were developed. Establishing targets for each indicator can be done by using pre-existing standard thresholds from the scientific literature or determining acceptable management goals. A threshold ideally indicates a tipping point where current knowledge predicts an abrupt change in an aspect or some aspects of ecosystem condition. Thus, from the perspective of choosing meaningful, health-related thresholds, this must be the point beyond which prolonged exposure to unhealthful conditions actually elicits a negative response, for the environment or human health. For example, prolonged exposure to dissolved oxygen concentrations below criteria thresholds elicits a negative response in aquatic systems by either compromising the biotic functions of an organism (reduced reproduction) or causing death.

More generally, however, thresholds represent an agreed-upon value or range indicating that an ecosystem is moving away from a desired state and toward an undesirable endpoint. Recognizing that many managed ecosystems have multiple and broad-scale stressors, another perspective is to define a threshold as representing the level of impairment that an environment can sustain before resulting in significant (or perhaps irreversible) damage. When selecting thresholds, it is important to recognize that there are many already available, and more than likely, there are thresholds available for the indicator that is chosen. A good place to start looking for existing thresholds and goals is in other report card methods or scientific reports and publications.

One way to develop threshold values, if none exist, is to relate them to management goals, and these goals can be used to guide the selection of appropriate indicators. Even with the definition of agreed-upon thresholds, there is still the question of how best to use these threshold values in a management and governance context. Recognizing this challenge, thresholds can still be effectively used to track ecosystem change and define achievable management goals for restoration, preservation, and conservation of an ecosystem. As long as threshold values are clearly defined and justified, they can be updated in light of new research or management goals and, therefore, can provide an important focus for the discussion and implementation of ecosystem management. Alternatively, if stressors are correctly identified and habitats appropriately classified, there should be multiple attributes (indicators) of the biological community that discriminate in predictable and significant ways between the least and most impaired habitat conditions. Reference communities can then be characterized using these data, which in turn can be used to develop threshold values.

In order to determine thresholds for the Everglades, the scientific experts who work most closely with the data were engaged. Thresholds came from a variety of sources including the RECOVER MAP and were developed for each indicator, if they did not already exist.

Northern Estuaries thresholds

Benthic infauna

Benthic infauna, or benthic fauna, are only monitored in the St. Lucie Estuary and Southern Indian River Lagoon. Details on sampling and statistical analysis can be found in Smithsonian Marine Station (2017). The scoring for this indicator is based on diversity of benthic species. The Simpson's Diversity Index was calculated for each site by year, and the inverse value was used as the score for that site. Simpson's Diversity Index is calculated on a scale of 0-1 so it could be easily converted to the report card scoring scale of 0-100. All of the site scores were averaged to the sub-region score.

Chlorophyll a

Chlorophyll a data were collected by the South Florida Water Management District (SFWMD) in SLE and CRE, and by the Loxahatchee River Environmental Control District in LRE.

Chlorophyll *a* was assessed based on the stoplight indicator methodology described in Boyer et al. (2009). This was the first time this method was used for the assessment of the chlorophyll *a* indicator status in the Northern Estuaries. The goal was to compare the annual median chlorophyll *a* (μg/L) concentrations to the long-term median at each station, which were calculated based on the monthly chlorophyll *a* (μg/L) data available for each station. The same method was used for all sub-regions of the Northern Estuaries, but the calculated station long-term medians were distinct (Table 9).

Annual median chlorophyll *a* (µg/L) values for each site were compared to the threshold for that site. If the value was above the threshold it scored 0%, if it was below the threshold it scored 100%. The site scores were then averaged for each estuary to estuary-specific scores.

Table 9: Chlorophyll a Thresholds

Sites	Period of record (water years)	Sampling frequency	Valid N	Threshold (Median)
		St. Lucie River Estuary		
HR1	1996–2018	monthly	268	9.1
SE08	1996–2018	monthly	264	8
SE03	1996–2018	monthly	269	6
SE02	1996–2018	monthly	267	5.5
SE01	1996–2018	monthly	271	4.4
SE11	1999–2018	monthly	232	3
		Loxahatchee River Estuary		
10	2007–2018	monthly	138	1.5
20	2007–2018	bi-monthly	70	1
30	2007–2018	bi-monthly	70	4.3
40	2007–2018	monthly	139	2.1
42	2007–2018	bi-monthly	70	4
51	2007–2018	bi-monthly	70	3.7
55	2007–2018	bi-monthly	67	6.2
60	2007–2018	monthly	137	5.6
62	2007–2018	monthly	136	5.9
65	2007–2018	monthly	137	4.4
72	2007–2018	monthly	139	10.1
		Caloosahatchee River Estuary		
4	2011–2018	monthly	84	5.2
5	2011–2018	monthly	84	5.8
6	2011–2018	monthly	83	4.1
8	2011–2018	monthly	84	2.2
9	2011–2018	monthly	84	2.3

Oysters

There are three metrics used to create the oyster scores for the Northern Estuaries; oyster density, oyster recruitment, and oyster Dermo (*Perkinsus marinus*) infection prevalence. The RECOVER oyster monitoring program includes density of settled oysters, reproductive development, juvenile recruitment, and prevalence and intensity of infection by the parasite Dermo. Monthly water quality sampling is conducted in conjunction with field sampling at each location. Methodology and sampling protocols are detailed in Parker and Radigan (2018).

The oyster density is measured as the number of live oysters per m^2. Thresholds for oyster density are based on historic data and are different for each region and site (Table 7). The density of each quadrat at a station was compared to the appropriate threshold for that station's site. If the density was higher than the threshold the quadrat scored a 100%, if it was lower the quadrat scored a 0%. The quadrats for each station were averaged to a station score, and then the station scores were averaged to a site score. Then the site scores for each sub-region were averaged to a sub-region score.

Table 7: Oyster Density Thresholds

Site Name	Site	Threshold (#/m^2)
Caloosahatchee River	CR	1000
Loxahatchee North	LX-N	500
Loxahatchee South	LX-S	500
St. Lucie Central	SL-C	500
St. Lucie North	SL-N	100
St. Lucie South	SL-S	100

The oyster recruitment is measured as the number of spat per shell per month. The threshold is 5 spat per shell per month. Thresholds for oyster recruitment are based on the Interim Goals and Interim Targets and are the same throughout the Northern Estuaries. If the recruitment was higher than the threshold the station scored a 100%, if it was lower the station scored a 0%. The station scores were averaged to a site score. Then the site scores for each sub-region were averaged to a sub-region score.

The oyster Dermo infection prevalence is measured as the percent of oysters infected. The threshold or goal is to have 0% of oysters infected. A higher infection percentage is a lower score. The inverse of the oyster Dermo infection prevalence was calculated using the equation: Score = 1-(DermoPrevalence/100). After the score was calculated for each station, the station scores were averaged to a site score. Then the site scores for each sub-region were averaged to a sub-region score.

These three metrics were equally averaged to the oyster score for each sub-region and for each water year.

Salinity

Salinity is measured by data loggers in the Northern Estuaries. In the St. Lucie Estuary there are three sites monitored by the USGS, the South Florida Water Management District (SFWMD), and the Ocean research and Conservation Association (ORCA). In the Caloosahatchee River Estuary there are two sites monitored by the SFWMD. In the Loxahatchee River Estuary there are three sites monitored by the Loxahatchee River District.

The St. Lucie Estuary has an established salinity envelope which is based on a healthy range for oysters, 12 to 20ppt at the US-1 bridge. The thresholds were based on this envelope. For any salinity measure between 12 and 20ppt the sample scored a 100%. For measurements outside this range, the scoring is scaled (Table 8). There are no target salinity ranges established for the CRE or LRE through the performance measures, so the established salinity envelope for the SLE was used for all three sub-regions. Each sample measurement was compared to the thresholds and scored. All the samples for a site were averaged to a site score. Then the site scores for each sub-region were averaged to a sub-region score.

Table 8: Salinity thresholds

Salinity (ppt)	Score (%)
0-3	0
4-7	25
8-11	75
12-20	100
21-25	75
26-30	50
31-35	25
36-38	0

Submerged aquatic vegetation

Submerged aquatic vegetation in the Northern Estuaries has different sampling, thresholds, and scoring for the three sub-regions. These differences are detailed below.

St. Lucie estuary and Southern Indian River Lagoon

From 2012-2017, seven 1-to-2-acre plots were monitored in the St. Lucie Estuary/Southern Indian River Lagoon. Throughout this region, five seagrass species have been commonly found: *Syringodium filiforme, Halodule wrightii, Halophila johnsonii, Halophila decipiens*, and *Thalassia testudinum*. Thresholds are based on Braun-Blanquet cover and abundance scores (BB Scores) and then converted to the 0-100% report card scoring scale (Table 2).

Table 2: Seagrass thresholds in the St. Lucie Estuary/Southern Indian River Lagoon

BB Scale	Report Card Scale	Equation
4	100	y = 25x
0	0	

Caloosahatchee River Estuary

From 2012-2017, six 1-2-acre plots were monitored in the Caloosahatchee River Estuary. Two sites located upstream in the Ft. Myers area have the SAV species *Ruppia maritima* and *Vallisneria americana*, the two sites downstream in the Iona Cove/Peppertree area are monospecific *Halodule wrightii* beds and two sites in San Carlos Bay are mixed beds of *Halodule* and *Thalassia testudinum*. Thresholds are based on Braun-Blanquet cover and abundance scores (BB Scores) and then converted to the 0-100% report card (RC) scoring scale. Within the Caloosahatchee River Estuary, different thresholds were used for sites in the Upper, Middle, and Lower Caloosahatchee. This is due to the difference in habitat conditions in different areas of the Caloosahatchee (Tables 3-5).

Table 3: Upper Caloosahatchee River Estuary Thresholds

Upper CRE (CRE_2; CRE_4)		
BB Scale	**RC Scale**	**Equation**
3	100	y = 33.333x

0	0

Table 4: Upper Caloosahatchee River Estuary Thresholds

Middle CRE (CRE_5; CRE_6)		
BB Scale	RC Scale	Equation
4	100	y = 25x
0	0	

Table 5: Upper Caloosahatchee River Estuary Thresholds

Lower CRE (CRE 7, CRE 8)		
BB Scale	RC Scale	Equation
5	100	y = 25x - 25
1	0	

Loxahatchee River Estuary

Seagrass species in Loxahatchee River Estuary include: *Syringodium filiforme, Halodule wrightii, Halophila johnsonii, Halophila decipiens,* and *Thalassia testudinum.* The SAV thresholds were determined using the historical optimum for each sampling site (Table 6). In the Loxahatchee there are six sampling sites, and each site has a different historic maximum where historical maximum is equal to the historical optimum per site. Historical Optimum (% Occurrence) = Highest Avg. % occurrence per site (by month and year). The historical optimum was compared to the average % occurrence of each sample by month and date. The average % occurrence was calculated as the average seagrass occurring in 1 m^2 quadrats (n= 21-34 replicate quadrats per site) per month during peak seagrass growing season (wet season). The score was calculated as the Avg. % occurrence/ Historical Optimum (% Occurrence). Sampling was conducted by the Loxahatchee River District.

Table 6: Loxahatchee River Estuary Thresholds

Site	Years of monitoring	Avg. Historical Optimum month & year of occurrence	Historical Optimum (% Occurrence)
Hobe Sound	2008-2015	Jun-08	99.2%
Inlet	2012-2018	Aug-13	91.3%
North Bay	2008-2018	Jun-12	94.0%
Northwest Fork	2008-2018	Aug-09	84.4%
Pennock Point	2008-2019	Aug-10	99.4%
Sand Bar	2008-2020	Apr-11	100.0%

Lake Okeechobee thresholds

Chlorophyll a

Chlorophyll a is monitored by the South Florida Water Management District at 17 sites. The indicator is measured as Chlorophyll a concentration. The threshold is based on the performance measure target for algal bloom frequency which is <5% of pelagic chlorophyll a exceeding 40 μg/L. The chlorophyll a exceedance frequency is calculated for each year from June to October. The frequencies are converted to the report card scoring scale based on the table and equation below (Table 13).

Table 13: Chlorophyll a Thresholds

% Freq of Chla >40ug/L	Score description	Report card Score (%)	Equation
<5	Very good	80-100	y = -4x +100
6-10	Good	60-80	y = -4x +100
11-15	Fair	40-60	y = -4x +100
16-20	Poor	20-40	y = -4x +100
>21	Very poor	0-20	y = -4x +100

Emergent aquatic vegetation

Emergent aquatic vegetation is evaluated by a complete mapping of the littoral marsh that occurs every three years, though annual assessments are done by evaluating coverage at a smaller scale; 50 individual 2.47 acre grids located at 24 representative sentinel sites distributed throughout the marsh. A RECOVER Performance Measure was established to quantify coverage targets, as well as interim goals of 50%–75% of targets, for many of the dominant plant communities found in the littoral marsh (Table 14).

Table 14: Emergent aquatic vegetation targets

Vegetation Type	Target (hectares)	Within 25% (hectares)	Within 50% (hectares)
Bulrush	1,900 or greater	1425-1,899	950-1,424
Beakrush/Spikerush	10,000 or greater	7,500-9,999	5,000-7,499
Sawgrass	1,900 or greater	1425-1,899	950-1,424
Cattail	8,000 or less	8,001-10,000	10,001-12,000
Willow	3,000 – 5,000	2,250-2,999 or 5,001- 6,250	1,500-2,999 or 5,001-7,499
Floating leaf above 3.88m	1,500 or less	1,501-1,875	1,501-2,250
Torpedograss	2,000 or less	2,001-2,500	2,001-3,000
Other Invasive Exotics	25 or less	26-32	33- 38
Woody Vegetation, Not Willow	500 – 1,500	375-499 or 1,501-1,875	250-499 or 1,501-2,250

For each vegetation type, the measured area was compared to the target area and given a score based on the table below (Table 15). The those scores were summed and converted to the report card scoring scale.

Table 15: Emergent aquatic vegetation scoring

Scoring	
in target	1
within 25% of range	0.5

within 26%-50% of range	0.25

Grading Scale

Report card score	Summed Score
80-100	8-9
60-79	6-7.75
40-59	4-5.75
20-39	2-3.75
0-19	0-1.75

Fish

There are two fish species evaluated in the report card, and each has two metrics. The species are Black crappie and Largemouth bass.

For Black crappie the catch rate (catch per unit effort or CPUE) is measured in fish per minute. Black crappie are monitored by the Florida Fish and Wildlife Conservation Commission annually in January, using the same trawl methods since 1973. The two metrics evaluated for this species are Age-1 fish and fish >=10 inches. Thresholds were established by experts at the Florida Fish and Wildlife Conservation Commission (Table 17 and Table 18).

Table 17: Black Crappie Age-1 Thresholds

CPUE	Score	% Score	Equation
>=3	4	80-100	y = 21.739x + 14.783
2.08-2.99	3	60-80	y = 21.739x + 14.783
0.71 -2.07	2	40-60	y = 14.599x + 29.635
0.16-0.7	1	20-40	y = 36.364x + 14.182
0- 0.15	0	0-20	y = 125x

Table 18: Black Crappie >=10 inches Thresholds

CPUE	Score	% Score	Equation
>1.30	4	80-100	y = 66.667x - 6.6667
1.00-1.29	3	60-80	y = 66.667x - 6.6667
0.51-0.99	2	40-60	y = 40.816x + 19.184
0.23-0.50	1	20-40	y = 71.429x + 3.5714
0-0.22	0	0-20	y = 86.957x - 0.000000000000004

Largemouth bass data were collected during annual lake-wide electrofishing samples conducted in October, which have used the same standardized methods since 1999 as described in Havens et al (2005). The two metrics evaluated for this species are Age-1 fish and >=12 inches. Thresholds were established by experts at the Florida Fish and Wildlife Conservation Commission (Table 19 and Table 20).

Table 19: Largemouth Bass Age-1 Thresholds

CPUE	Score	% Score	Equation
>0.130	4	80-100	y = 454.55x + 20.909

0.086-0.129	3	60-80	y = 434.78x + 22.609
0.040-0.085	2	40-60	y = 400x + 24
0.016-0.039	1	20-40	y = 833.33x + 6.6667
0-0.015	0	0-20	y = 1250x - 0.000000000000003

Table 20: Largemouth Bass >=12 inches Thresholds

CPUE	Score	% Score	Equation
>0.3	4	80-100	y = 285.71x - 5.7143
0.230-0.290	3	60-80	y = 285.71x - 5.7143
0.136-0.229	2	40-60	y = 212.77x + 11.064
0.065-0.135	1	20-40	y = 281.69x + 1.6901
0-0.064	0	0-20	y = 307.69x

All metrics were scored and the scores were equally averaged to an overall fish score for each year.

Stage Envelope

Stage envelope, or lake stage, thresholds are based on the lake stage as it varies during different times of the year (Figure 1).

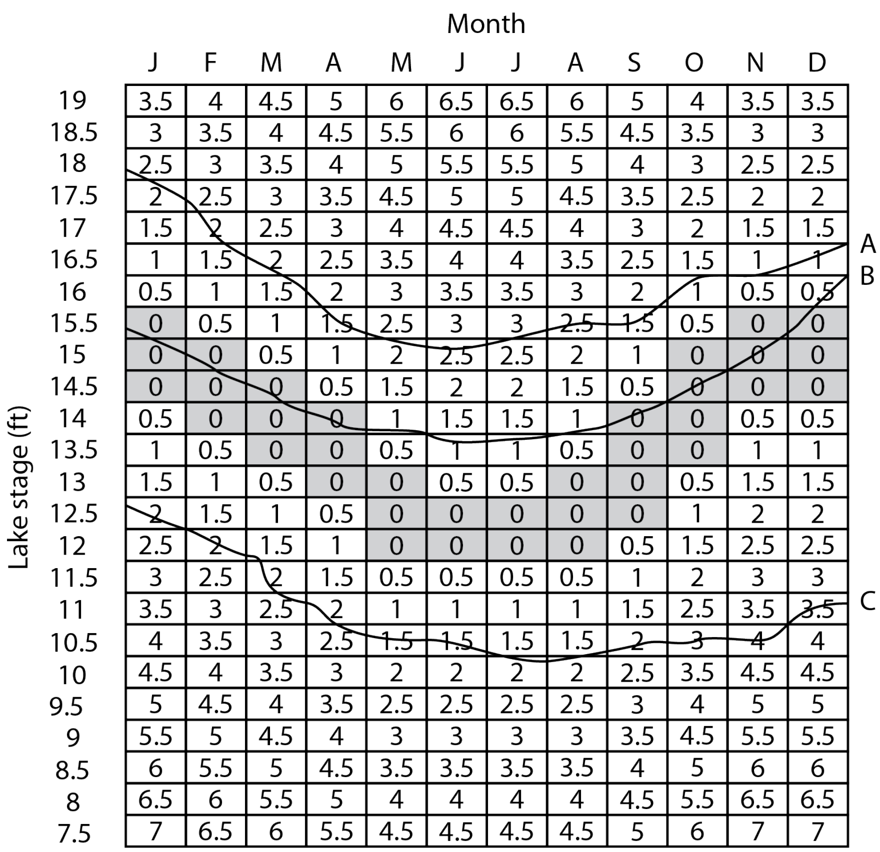


Figure 1: Lake stages by month.

Depending upon the lake stage, and what month it is sampled, different scoring is applied. The average stage for each month is scored based on the thresholds below (Table 10). After each month is scored, the months are averaged to a score by water year. The water year score is converted to the 0-100% scale.

Table 10: Lake stage thresholds by month

Month	0 points	1 point	2 points
January	<13.5 ft, >16.5 ft	>13.5 - <14.5 ft, >15.5 - <16.5 ft	14.5 - 15.5 ft
February	<13 ft, >16 ft	>13 - <14 ft, >15 - <16 ft	14 - 15 ft
March	<12.5 ft, >15.5 ft	>12.5 - <13.5 ft, >14.5 - <15.5 ft	13.5 - 14.5 ft
April	<12 ft, >15 ft	>12 - <13 ft, >14 - <15 ft	13 - 14 ft
May	<11 ft, >14 ft	>11 - <12 ft, >13 - <14 ft	12 - 13 ft
June	<11 ft, >13.5 ft	>11 - <12 ft, >12.5 - <13.5 ft	12 - 12.5 ft
July	<11 ft, >13.5 ft	>11 - <12 ft, >12.5 - <13.5 ft	12 - 12.5 ft
August	<11 ft, >14 ft	>11 - <12 ft, >13 - <14 ft	12 - 13 ft
September	<11.5, >15 ft	>11.5 - <12.5 ft, >14 - <15 ft	12.5 - 14 ft
October	<12.5, >16 ft	>12.5 - <13.5, >15 - <16 ft	13.5 - 15 ft
November	<13.5 ft, >16.5 ft	>13.5 - <14.5 ft, >15.5 - <16.5 ft	14.5 - 15.5 ft
December	<13.5 ft, >16.5 ft	>13.5 - <14.5 ft, >15.5 - <16.5 ft	14.5 - 15.5 ft

Submerged aquatic vegetation

The submerged aquatic vegetation (SAV) indicator is based on annual summer SAV mapped by the Lake Okeechobee biologists at the South Florida Water Management. The thresholds are based on the Interim Targets and Interim Goals of July/August vascular and/or non-vascular (almost exclusively Chara spp.) covering a combined >50,000 acres, which is 50% of the nearshore region. The nearshore region is roughly defined as occurring between the 5.5 ft and 12 ft elevated contours. The thresholds set 50,000 acres as the best score, and use multiple thresholds for the other scoring bins (see table below). The total SAV acreage for each year was given a score and then converted to the report card score using the equations in Table 16.

Table 16: SAV Thresholds

Score	SAV acres	Report Card Score (%)	Equation
4	>=50000	80-100	y = 0.0027x - 53.333
3	42,500 - 49,999	60-<80	y = 0.0027x - 53.333
2	35000 - 42,499	40-<60	y = 0.0027x - 53.333
1	17,500 - 34,999	20-<40	y = 0.0011x
0	0 - 17,499	0-<20	y = 0.0011x

Wading Bird Interval

The Wading Bird Interval indicator evaluates the mean interval between exceptional nesting years (MIEN), which was based on a Greater Everglades Ecosystem performance measure that monitors the interval between exceptional nesting events for White Ibis (Frederick et al. 2009). Three species are evaluated within this indicator, the Great Egret (*Ardea alba*; GREG), Snowy Egret (*Egretta thula*; SNEG), and White Ibis (*Eudocimus albus*; WHIB). The desired condition is to decrease the interval between exceptional nesting years. Exceptional years are defined as the 70th percentile of all nest abundance estimates in the period of record.

First the interval between exceptional nesting years is counted. Exceptional nesting years are assigned an interval of zero and consecutive years in which nest abundance was below the 70th percentile are summed to calculate the length of intervals between exceptional nesting years. The average of all counts is calculated to determine the mean and standard deviation for the interval during the period of record. The mean interval minus the standard deviation is the target. To convert to the report card scoring scale the target (mean interval-standard deviation) was set at the 50% report card score and the mean interval at the 0% score. Then calculated the equations for the conversions were calculated for each species (Tables 21-23).

Table 21: Great Egret Thresholds

GREG		
Mean interval	**Scoring scale**	**Equation**
0	100	y = -22.321x + 100
2.24	50	y = -22.321x + 100
2.75	0	y = -98.039x + 269.61

Table 22: Snowy Egret Thresholds

SNEG		
Mean interval	**Scoring scale**	**Equation**
0	100	y = -23.697x + 100
2.11	50	y = -23.697x + 100
2.68	0	y = -87.719x + 235.09

Table 23: White Ibis Thresholds

WHIB		
Mean interval	**Scoring scale**	**Equation**
0	100	y = -25.773x + 100
1.94	50	y = -25.773x + 100
2.5	0	y = -89.286x + 223.21

Wading Bird Proportion

The Wading Bird Proportion indicator evaluates the mean percentage of maximum nest abundance (PMNA) observed during the current reporting period. Three species are evaluated within this indicator, the Great Egret (*Ardea alba*; GREG), Snowy Egret (*Egretta thula*; SNEG), and White Ibis (*Eudocimus albus*; WHIB).

PMNA is calculated by dividing the mean 5-yr running average of nest abundance during the reporting period by the average of the 5 highest nest abundances during the period of record. This calculation reduces the effect of years with extremely low or high nest abundance on the performance measure score. The target value for PMNA is 100% of maximum nest abundance and the score is presented as a percentage between 0% and 100%.

Water Clarity

Water clarity is monitored by the South Florida Water Management District at 8 sites and evaluated annually by assessing the secchi depth. The secchi depth was divided by the overall depth to determine the secchi to total depth ratio. The ratio was given 0, 1, or 2 points based on the table below (Table 11).

Table 11: Water Clarity Ratios

Ratio	Points
0-0.49	0
0.50-0.74	1
0.75-1.0	2

All of the samples were given a point score for each site by month. The sites for each month were averaged to a monthly score. The monthly scores were multiplied by 100 to create a percentage. The monthly scores were averaged to a water year score. These scores were converted to the report card scoring scale based on the following table and equations (Table 12).

Table 12: Water Clarity Thresholds

Monthly scores (%)	Score description	Report card Scores (%)	Equation
0 - 49	Very poor	0-<20	$y = 0.4x$
50 - 59	Poor	20-<40	$y = 2x - 80$
60 - 74	Fair	40-<60	$y = 1.3333x - 40$
75 - 89	Good	60-<80	$y = 1.3333x - 40$
90 - 100	Very good	80-100	$y = 2x - 100$

Greater Everglades thresholds

Alligators

The American Alligator (*Alligator mississippiensis*), is monitored by the University of Florida with USGS and USFWS. The indicator scoring and thresholds (Table 41 and Table 42) are based on the stoplight indicator (Ecological Indicators Special Issue and System-wide reports). In each area, the stoplight score was calculated and then converted to the report card scoring scale. Then the area scores were averaged to an overall score for each water year.

Table 41: Alligator stoplight indicator

Stoplight color bounds	Color
0-0.4	Red
>0.4-0.8	Yellow
>0.8-1	Green

Table 42: Alligator thresholds

Stoplight bound	Report card score	Equation
0	0	y = 95x
0.2	19	y = 50x + 9
0.3	24	y = 100x - 6
0.4	34	y = 71.429x + 5.4286
0.47	39	y = 83.333x + 0.1667
0.53	44	y = 142.86x - 31.714
0.6	54	y = 71.429x + 11.143
0.67	59	y = 83.333x + 3.1667
0.73	64	y = 142.86x - 40.286
0.8	74	y = 100x - 6
0.85	79	y = 100x - 6
0.9	84	y = 200x - 96
0.95	94	y = 120x-20
1	100	y = 120x-20

Invasive reptiles

Burmese pythons (*Python bivittatus*), northern African pythons (*Python sebae*), Argentine black and white tegus (*Salvator merianae*), Nile monitors (*Varanus niloticus*), and spectacled caiman (*Caiman crocodilus*) were selected as performance measures (PMs) for invasive reptiles in the Greater Everglades based on presence in the Greater Everglades ecosystem, relevance as targets of interagency management efforts, and existence of adequate information for scoring. Each PM was scored based on three metrics: abundance, spread, and impacts. The primary data source was EDDMapS (www.eddmaps.org/florida/Species/) data on distribution and occurrence, supplemented with data from the Everglades Invasive Reptile and Amphibian Monitoring Program, and the Florida Fish and Wildlife Conservation Commission. Scores for each PM were totaled and assigned a stoplight color and score.

For each species, abundance, spread, and impact are each given a score of 0, 1, or 2 (Table 39).

Table 39: Invasive reptiles metrics and scoring

Metric	Status	Score
Abundance	Increasing	2
	No change	1
	Decreasing	0

Spread	Expanding	2
	No change	1
	Contracting	0
Impacts	Established	2
	Potential	1
	Minimal	0

Species scores are summed into an overall score. The observed overall score is divided by the total possible score, and multiplied by 100. Then converted to the report card score (Table 40).

Table 40: Invasive reptiles thresholds

Regional Score	Stoplight	Report Card Score (%)	Equation
0-10	Green	100-80	y = -1.9091x +100
11-25	Green	79-60	y = -1.3333x + 93.667
26-40	Yellow	59-55	y = -0.2667x + 65.933
41-60	Yellow	55-45	y = -0.55x + 77.55
61-75	Yellow	44-40	y = -0.3333x + 64.333
76-90	Red	39-20	y = -1.3333x + 140.33
91-100	Red	19-0	y = -2.1111x + 211.11

Marl Prairie

Evaluation of marl prairie conditions includes an analysis of EDEN data-derived hydrologic metrics (USFWS 2006), and an assessment of the change in vegetation-inferred hydroperiod (Armentano et al. 2006). Analyzing relative changes in vegetation-inferred hydroperiod between successive sampling years tests the hypothesis that vegetation in the Cape Sable seaside sparrow (CSSS) habitat has changed in response to short-term hydrological changes over the same period. There are two indicators for Marl Prairie; vegetation inferred hydroperiod (Marl Prairies and Slough Gradient) and vegetation inferred hydroperiod (Cape Sable seaside sparrow habitat). Thresholds for both metrics are based on Frequency occurrence of CSSS in relation to Vegetation-inferred hydroperiod (Ross et al. 2006) and the criteria defined in (USFWS 2016). The criteria are 0-89 days = too dry, 90-210 days = Optimal condition, 210-240 days = Wet condition, and >240 days = Too wet. See thresholds and conversion equations to report card scores in Table 36.

Table 36: Marl prairie thresholds

Indicator value	Percent score	Equation
0	0	y = 0.8889x
90	80	y = 0.8889x
120	100	y = 0.6667x + 20
180	100	y = 100
210	80	y = -0.6667x + 220
240	60	y = -0.6667x + 220

The scores for each metric were calculated and then the two metric overall scores were averaged together to an overall Marl Prairie score for the time period evaluated. Due to the sampling program, the most recent years of data available were used for each indicator. Vegetation inferred hydroperiod (Marl Prairies and Slough Gradient) metric includes data for water years 2012-2017. Vegetation inferred hydroperiod (Cape Sable seaside sparrow habitat) metric includes data for water years 2015-2018.

Non-native fish

Non-native fish are measured by collecting fish in $1m^2$ traps. The index for this indicator is the proportion of all fish collected that are non-native species. If the proportion is greater than 0.02 (2%) it exceeds the target; if it is greater than 0.0 but less than 0.01 it is a concern; if it is equal to 0, it meets target. These thresholds are based on the stoplight indicator. They are converted to the report card scoring scale using the equation below (Table 38). After the scores are calculated for each region, they are averaged to an overall score by water year.

Table 38: Non-native fish thresholds

Target	Score	Equation
2	0	y = -50x + 100
1	50	y = -50x + 100
0	100	y = -50x + 100

Periphyton

There are three metrics that make up the periphyton indicator, total phosphorus, biomass, and endemic diatoms.

Total phosphorus (TP) is measured as the TP in periphyton in ug g^{-1} dw (dry weight). The thresholds are based on regionally-expected values for each wetland region which correspond with impaired, cautionary, or baseline condition (according to Gaiser 2009), and assigned a value of 0, 50 or 100%, respectively (Table 24).

Table 24: Total Phosphorus Thresholds

Total Phosphorus		
Wetland region	**TP value (µg g-1 dw)**	**Score**
LOX	0 - <500	100%
LOX	500 - 600	50%
LOX	>600	0%
SRS	0 - <200	100%
SRS	200 - 300	50%
SRS	>300	0%
TSL	0 - <150	100%
TSL	150 - 200	50%
TSL	>200	0%
WC2	0 - <200	100%
WC2	200 - 300	50%
WC2	>300	0%

WC3	0 - <300	100%
WC3	300 - 400	50%
WC3	>400	0%

Biomass is measured as the Mat Ash-Free Dry mass (g m^{-2}). The thresholds are based on regionally-expected values for each wetland region which correspond with impaired, cautionary, or baseline condition (according to Gaiser 2009), and assigned a value of 0, 50 or 100%, respectively (Table 25).

Table 25: Biomass Thresholds

Biomass		
Wetland region	**Biomass (g m^{-2})**	**Score**
LOX	<10	100%
LOX	10 - 20	50%
LOX	>20	0%
SRS	>20	100%
SRS	20 - 1	50%
SRS	<1	0%
TSL	>50	100%
TSL	50 - 1	50%
TSL	<1	0%
WC2	>20	100%
WC2	20 - 1	50%
WC2	<1	0%
WC3	>10	100%
WC3	10 - 1	50%
WC3	<1	0%

Endemic diatoms are measured as the percent endemic diatoms. The thresholds are based on regionally-expected values for each wetland region which correspond with impaired, cautionary, or baseline condition (according to Gaiser 2009), and assigned a value of 0, 50 or 100%, respectively (Table 26).

Table 26: Endemic Diatoms Thresholds

Endemic Diatoms		
Wetland region	**Endemic diatoms (%)**	**Score**
LOX	0 - <10	100%
LOX	10 - 70	50%
LOX	>70	0%
SRS	>95	100%
SRS	95 - 75	50%
SRS	<75	0%
TSL	>95	100%
TSL	95 - 75	50%

TSL	<75	0%
WC2	>95	100%
WC2	95 - 75	50%
WC2	<75	0%
WC3	>95	100%
WC3	95 - 75	50%
WC3	<75	0%

Scores for each of the three metrics are calculated for each site and then the individual site scores are averaged for each wetland region. The wetland region scores are averaged to the overall score by water year. Then the water year scores for the three metrics are averaged into the overall periphyton score.

Prey abundance

Sampling methods of small fish (< 8 cm standard length) and crustaceans use a 1-m^2 throw trap to obtain estimates of density of species collected. Data were collected 5 times per year (February, April, July, October, and December). Targets for the aquatic fauna indicator are dynamic based on observed rainfall and resulting hydrological fluctuation observed in the mid-1990's when water stages were like those predicted for the pre-management ecosystem. Dynamic targets adjust expectations such that in years with low rainfall the target is lower abundance of fish and crustaceans than in periods of greater rainfall. The thresholds are based on the stoplight indicator and aquatic fauna abundance is calculated as an index that is the density of all fish species summed. This is given a rank of 1-3. The rankings are converted to a 0-100% scale (Table 37). The scores are averaged for each region into a water year score.

Table 37: Prey abundance thresholds

Rank	Score	Equation
1	100	y = -50x + 150
2	50	y = -50x + 150
3	0	y = -50x + 150

Prey availability

Prey availability, or dry season prey availability, is monitored during the dry season (approximately January–May). Prey availability includes fish, crayfish, grass shrimp, and other prey items. Nest abundance estimates are also used in the indicator calculation (Great Egret, White Ibis, Wood Stork, and small herons). The prey availability indicator is measured as the interval between exceptional prey density years which is based on the performance measure. To receive the highest score for a period of interest, the mean interval between exceptional prey density will be at least one standard error below the average time interval between exceptional nesting years. Decreasing intervals indicate that exceptional prey density years are occurring more frequently than exceptional nesting years. The score is calculated as the (target score / (by the mean interval during the reporting period - the standard error)) *100.

Ridge and slough landscape

The ridge and slough landscape sampling design is based on the Generalized Random-Tesselation Stratified approach (Stevens and Olsen 2003) and primarily included 80 2km by 5km cells, also called Probabilistic Sampling Units (PSUs) (Philippi 2007). Over five years, 66 PSUs were sampled. However, four PSUs sampled in first two years were in marl prairies, outside the historical R&S landscape, and thus were not included in subsequent analysis for calculating various indicators.

The ridge and slough landscape indicator is based on six metrics: microtopography variability, elevation mode differences, site hydrology, vegetation community distinctness, vegetation-elevation relationship, and Ridge-Slough elevation difference. For each indicator, thresholds for each indicator categories were determined based on the data distribution pattern and expert view. For all indicators, the indicator values were converted to the report card scoring scale using equations.

Microtopography variability: Spatial variability of soil elevation represented by standard deviation of mean water depth across all points sampled within each PSU. Thresholds are listed in Table 27.

Table 27: Microtopography variability thresholds

Indicator category	Indicator value	Percent score	Equation
High	10.0-16.4	80-100	y = 3.2308x + 47.015
Medium	7.5-9.9	60-80	y = 8x - 0.2
Low	5.0-7.4	40-60	y = 8x - 0.2
Very Low	<5.0	0-40	y = 7.9592x

Elevation mode differences: Peat surface elevation (Water depth) difference between two modes of bimodality distribution curve, i.e. when there was bimodal distribution of elevations within a PSU. Thresholds are listed in Table 28.

Table 28: Elevation mode differences thresholds

Indicator category	Indicator value	Percent score	Equation
Conserved	>18.0	80-100	y = 4.878x - 8.2927
Moderately conserved	18.0-10.0	40-80	y = 4.878x - 8.2927
Degraded	<10.0	0-40	y = 4.878x - 8.2927

Site hydrology: Long-term (20+ years) mean water depth. Thresholds are listed in Table 29.

Table 29: Site hydrology thresholds

Indicator category	Indicator value	Percent score	Equation
Optimum	35.0-50.0	100-80	y = -2.6667x + 213.33 and y = 2.6667x - 13.333
Appropriate	25.0-34.9 and 50.1-60.0	80-40	y = 3.9604x - 58.614 and y = -3.9604x + 278.02
Deep	>60.0	40-0	y = -3.9604x + 278.02
Shallow	<25.0	40-0	y = 3.9604x - 58.614

Vegetation community distinctness: How distinct the vegetation community is with regard to species distribution. This indicator was developed and scored using a non-metric multidimensional scaling (NMDS) ordination to represent the compositional differences among sites within a PSU followed by K-means clustering with two distinct clusters, and calculation of the distance between two vegetation clusters. Thresholds are listed in Table 30.

Table 30: Vegetation community distinctness

Indicator category	Indicator value	Percent score	Equation
Very distinct	>=1.10	80-100	y = 64.516x + 9.0323
Moderately distinct	0.80-1.09	60-80	y = 64.516x + 9.0323
Less distinct	0.50-0.79	40-60	y = 66.667x + 7.3333
Almost indistinct	< 0.50	0-40	y = 81.633x - 7E-15

Vegetation Elevation Relation: Vegetation-elevation correlation represented by Mantel_r. Thresholds are listed in Table 31.

Table 31: Vegetation Elevation Relation thresholds

Indicator category	Indicator value	Percent score	Equation
Highly correlated	>0.30	80-100	y = 400x - 40
Moderately correlated	0.20-0.30	40-80	y = 400x - 40
Weakly correlated	<0.20	0-40	y = 400x - 40

Ridge-Slough elevation difference: Difference in relative elevation between Ridge & Slough. Thresholds are listed in Table 32.

Table 32: Ridge-Slough elevation difference thresholds

Indicator category	Indicator value	Percent score	Equation
Relatively high	> 15.0	80-100	y = 4x + 20
Medium	10.0-14.90	60-80	y = 4x + 20
Low	5.0-9.9	40-60	y = 4x + 20
Almost flat	< 5.0	0-40	y = 8x

The scores for each metric were calculated and then the six metric overall scores were averaged together to create an overall Ridge & Slough landscape score for the time period evaluated. Due to the sampling program, the five most recent years of data were used for each indicator. For three of the indicators that includes data for water years 2013-2017 (microtopography variability, elevation mode differences, and site hydrology). The other three indicators only include data for water years 2010-2015 (vegetation community distinctness, vegetation elevation relation, and Ridge-Slough elevation difference).

Tree Islands

The four tree islands annually monitored from 2012–2017 were the subset of a network of 16 tree islands that were studied for varying periods within both the ridge and slough (R&S) and marl prairies (MP) landscapes in the Everglades National Park. The tree islands indicator includes three metrics; Regeneration, Tree Basal Year Change, and Invasive Exotic Species.

Regeneration: Ingrowths-Mortality (percent/year), Tree (<= 5 cm dbh) i.e. ingrowth minus mortality percentage in hardwood hammock plots. Thresholds are listed in Table 33.

Table 33: Regeneration thresholds

Indicator category	Indicator value	Percent score	Equation
Higher ingrowths	0.02 – 7.14	80-100	y = 2.9412x + 79
Equilibrium	0	60-80	y = 0
Poor regeneration	-0.01 – -3.00	40-60	y = 6.6667x + 59
Very poor regeneration	-3.00 – -10.00	20-40	y = 2.8571x + 47.571
Extremely poor regeneration	-10.01 – -15.00	0-20	y = 3.8x + 57

Tree Basal Year Change (m^2/ha/year): Tree (<= 5 cm dbh) growth represented by annual change in basal area per ha in hardwood hammock plots. Thresholds are listed in Table 34.

Table 34: Tree Basal Year Change thresholds

Indicator category	Indicator value	Percent score	Equation
Moderately high growth	> 1.000	100	y = 20.979x + 79
Moderate growth	1.000 – 0	80-100	y = 20x + 79
Poor growth	-1.000 – -0.001	60-80	y = 20x + 79
Medium poor growth	-2.000 – -1.001	40-60	y = 5x + 49
Very poor growth	-6.000 – -2.001	20-40	y = 4.75x + 47.5
Extremely poor growth	-6.001 – -10.000	0-20	y = 4.75x + 47.5

Invasive-Exotic Species (% Freq. of Occurrence): Frequency (Percent occurrence) of invasive exotic woody species/climbers observed on each transect on 12 sampled tree islands. Thresholds are listed in Table 35.

Table 35: Invasive-Exotic Species thresholds

Indicator category	Indicator value	Percent score	Equation
Absent	0	80-100	y = -210x +100
Less frequent	0.1 - 5.0	60-80	y = -4x + 79.4
Moderately frequent	5.1 - 15.0	40-60	y = -2x + 69.2
Highly frequent	15.1 - 25.0	20-40	y = -2.0202x + 69.505
Most frequent	>25.0	0-20	y = -2.0202x + 69.505

The scores for each metric were calculated and then the three metric overall scores were averaged together to an overall Tree Islands score for each water year. The invasive exotic score does not include water year 2017 data, as it was not sampled during that time.

Wading Birds

Four indicators are used to gauge progress towards restoration of wading bird populations; wood stork nesting initiation, proportion of nesting in the coastal zone, Ibis supercolony, and proportion of tactile foragers.

Wood stork nesting initiation, or timing of nesting, is a score from 1 (March) to November (5) that rates how early Wood Storks nest in the Everglades (Table 43). This is defined as the month of first egg laying in any colony within the WCAs, ENP, or Lake Okeechobee. The score is expressed for any year as a four-year running average.

Table 43: Wood stork nesting initiation index scores

Month	Index score
November	5
December	4
January	3
February	2
March	1
Target four-year running mean =	4.5

These index scores are converted to the report card scoring scale (Table 44).

Table 44: Wood stork nesting initiation thresholds

Index	Score	Equation
0	0	y = 19x
1	19	y = 19x
2	25	y = 6x + 13
3	55	y = 30x - 35
4	79	y = 24x - 17
4.5	100	y = 42x - 89

Proportion of nesting in the coastal zone, or colony location, is the second metric. More than 90% of the nesting of the indicator species occurred in the southern ecotone region during the 1930s and early 1940s, in all likelihood because this was the most productive area. A restoration hypothesis holds that it is the reduction of freshwater flows to this coastal region that has reduced secondary productivity and resulted in the abandonment of the area by nesting wading birds. The proportion of the entire mainland Everglades nesting population that nests in the coastal zone is one of the restoration indicators, with at least 50% of nesting as the restoration target. The total nests in the coastal zone is divided by the total nests to calculate the proportion. This index value is a five-year running mean of the annual proportions. This score is converted to the report card scoring scale (Table 45).

Table 45: Proportion of nesting in the coastal zone thresholds

Index value	Report card score	Equation
0	0	y = 1.9x
10	19	y = 1.9x
20	39	y = 2x - 1
30	59	y = 2x - 1
40	79	y = 2x - 1
50	100	y = 2.1x - 5

Ibis supercolony, or exceptionally large Ibis aggregations, were characteristic of the predrainage system, and are thought to be indicators of the ability of the wetland system to produce very large pulses of prey resulting in part from typical cycles of drought and flood. Large breeding aggregations during the recent period are defined as being above 16,977 nests each year, defined as the 70th percentile of the entire period of record of annual nestings. The interval between large ibis nestings in the predrainage period was 1.6 years and this serves as the target for restoration. The score is a five-year running mean of the annual proportions. 1.6 years was set as the best score and multiple thresholds were established from that (Table 46).

Table 46: Ibis supercolony thresholds

Index	Report card score	Equation
20	19	y = -4x +99
15	39	y = -4x +99
10	59	y = -4x +99
5	79	y = -4x +99
1.6	100	y = -6.1765x +109.88

Proportion of tactile foragers, or the ratio of visual to tactile foragers, is the fourth metric. The breeding wading bird community has shifted from being numerically dominated by tactile foragers (storks and ibises) during the pre-drainage period to one in which visual foragers such as Great Egrets are numerically dominant. This shift is thought to have occurred as a result of impounded, stabilized, or over drained marsh, which leads to the declining availability both of larger forage fishes (Wood Storks) and crayfishes (ibises). These conditions favor species like Great Egrets that are less reliant on the entrapment of prey. Restoration target = 32 breeding tactile foragers to each breeding visual forager, characteristic of 1930s breeding assemblages. Ratio = Ibis + Storks : Egrets. The score is a five-year running mean of the annual proportions. The index values were converted to the report card scoring scale using multiple thresholds (Table 47).

Table 47: Proportion of tactile foragers thresholds

Index value	Score	Equation
5	19	y = 4x - 1
10	39	y = 4x - 1
15	59	y = 4x - 1
25	79	y = 2x + 29
32	100	y = 3x + 4

The four metrics were equally averaged to an overall wading birds score for each water year.

Southern Coastal Systems Thresholds

Biscayne Bay thresholds

Chlorophyll a

Chlorophyll a monitoring is conducted by the Miami-Dade Department of Environmental Management (DERM), the South Florida Water Management District, and

NOAA. Thresholds are based on the stoplight thresholds from Boyer et al. (2009). The three stoplight intervals were converted to 5 even scoring intervals on a 0-100 scale. Calculations for these 5 intervals by linear regressions of report card scores as a function of quartile values (Table 51).

1) Very good, (dark green) regression between within 0 to 25th percentile range of the reference chlorophyll a distribution (0-20 points with linear interpolation between range endpoints).
2) Good (light green) for 25th to 50th percentile range as above.
3) Fair (yellow), poor (orange), and red intervals with regression of the interval from the 50th percentile to the 75th percentile values (including an arithmetic midpoint between the 50th% and 75th%, which does not affect the regression but demarks the yellow-orange boundary), representing 20 points per interval.
4) Poor (orange) being on the other side of this midpoint, from the midpoint to the 75th% value, representing 20 points.
5) Very poor (red) extrapolates from the 50th% to 75th% regression representing 20 points, and has a score of 0 at the x-axis intercept.

Table 51: Chlorophyll a quartile values

Sub-region	Zone	25th percentile	Median	Midpoint median to 75th percentile	75th percentile
South Biscayne Bay	SBB	0.181	0.264	0.345	0.426
Central Biscayne Bay	CBB	0.2	0.313	0.4395	0.566
North Biscayne Bay	NBB	0.67	1.048	1.348	1.648

The scores were calculated for each zone and the zones were averaged to the sub-region scores.

Crocodiles

The American Crocodile (*Crocodylus acutus*), is monitored by the University of Florida with USGS and USFWS. The indicator scoring and thresholds (Table 53 and Table 54) are based on the stoplight indicator (Ecological Indicators Special Issue and System-wide reports). In each area, the stoplight score was calculated and then converted to the report card scoring scale. Then the area scores were averaged to an overall crocodiles score for each water year.

Table 53: Crocodile stoplight indicator

Stoplight color bounds	Color
0-0.4	Red
>0.4-0.8	Yellow
>0.8-1	Green

Table 54: Crocodile thresholds

Stoplight bound	Report card score	Equation
0	0	y = 95x
0.2	19	y = 50x + 9
0.3	24	y = 100x - 6
0.4	34	y = 71.429x + 5.4286

0.47	39	y = 83.333x + 0.1667
0.53	44	y = 142.86x - 31.714
0.6	54	y = 71.429x + 11.143
0.67	59	y = 83.333x + 3.1667
0.73	64	y = 142.86x - 40.286
0.8	74	y = 100x - 6
0.85	79	y = 100x - 6
0.9	84	y = 200x - 96
0.95	94	y = 120x-20
1	100	y = 120x-20

Gulf pipefish

Gulf pipefish is an epifauna throw trap indicator, which measures the abundance of gulf pipefish. The data comes from the Integrated Biscayne Bay Ecological Assessment and Management (IBBEAM) project. Scoring based on presence/absence of gulf pipefish in sample. If gulf pipefish were present in the sample it scores a 1, if there were none, then it scores a 0. These values are averaged for the season by year. The average is divided by the threshold and multiplied by 100. Thresholds are based on reference conditions that are separate for Wet and Dry seasons (Table 48). The separate scores for wet and dry season were averaged for each water year to reach an overall gulf pipefish score.

Table 48: Gulf pipefish thresholds

Reference	
Wet	**Dry**
0.5	1
100	100

Goldspotted killifish

Goldspotted killifish is a mangrove fish indicator, which measures the abundance of gold spotted killifish. The data comes from the Integrated Biscayne Bay Ecological Assessment and Management (IBBEAM) project. Scoring based on presence/absence of gold spotted killifish in sample. If goldspotted killifish were present in the sample it scores a 1, if there were none, then it scores a 0. These values are averaged for the season by year. The average is divided by the threshold and multiplied by 100. Thresholds are based on reference conditions that are separate for Wet and Dry seasons (Table 49). The separate scores for wet and dry season were averaged for each water year to reach an overall goldspotted killifish score.

Table 49: Goldspotted killifish thresholds

Reference	
Wet	**Dry**
0.5	1
100	100

Salinity

Salinity data comes from the Integrated Biscayne Bay Ecological Assessment and Management (IBBEAM) project. Scoring is based on the maximum duration of mesohaline conditions. It is measured as the number of days of mesohaline conditions. These values are averaged for the season by year. The average is divided by the threshold and multiplied by 100. Thresholds are based on reference conditions that are separate for Wet and Dry seasons (Table 50). The separate scores for wet and dry season were averaged for each water year to reach an overall salinity score.

Table 50: Salinity thresholds

Reference		
	Wet	**Dry**
Days	34.25	78.42
Score	100	100

Submerged aquatic vegetation

Submerged aquatic vegetation (SAV) data come from the Integrated Biscayne Bay Ecological Assessment and Monitoring (IBBEAM) project. SAV data are collected in the dry and wet seasons at 47 sites located < 100 m from shore between Matheson Hammock and Turkey Point. Thresholds are based on presence weights of different species groups and Site cover/Max cover for that site. The presence weights were selected based on the restoration targets for SAV that aim to reduce the over-dominance of *Thalassia* and increase the abundance of *Halodule* (Table 52). These two metrics are multiplied together and then averaged over the year.

Table 52: SAV presence weights thresholds

Presence weights	Score
No seagrass	0
Only Thalassia	0.5
Only Halodule	0.75
Both Halodule and Thalassia	1

Florida Bay Thresholds

Chlorophyll a

Chlorophyll a monitoring is conducted by the Miami-Dade Department of Environmental Management (DERM), the South Florida Water Management District, and NOAA. Thresholds are based on the stoplight thresholds from Boyer et al. (2009). The three stoplight intervals were converted to 5 even scoring intervals on a 0-100 scale. Calculations for these 5 intervals by linear regressions of report card scores as a function of quartile values (Table 55).

1) Very good, (dark green) regression between within 0 to 25th percentile range of the reference chlorophyll a distribution (0-20 points with linear interpolation between range endpoints).
2) Good (light green) for 25th to 50th percentile range as above.
3) Fair (yellow), poor (orange), and red intervals with regression of the interval from the 50th percentile to the 75th percentile values (including an arithmetic midpoint between the 50th% and 75th%, which does not affect the regression but demarks the yellow-orange boundary), representing 20 points per interval.
4) Poor (orange) being on the other side of this midpoint, from the midpoint to the 75th% value, representing 20 points.
5) Very poor (red) extrapolates from the 50th% to 75th% regression representing 20 points, and has a score of 0 at the x axis intercept.

Table 55: Chlorophyll a quartile values

Sub-region	Zone	25th percentile	Median	Midpoint median to 75th percentile	75th percentile
West Florida Bay	WFB	0.653	1.345	2.095	2.845
South Florida Bay	SFB	0.327	0.533	0.796	1.059
North-central Florida Bay	NCFB	0.585	1.216	2.463	3.71
Northeast Florida Bay	NEFB	0.254	0.417	0.6035	0.79
Blackwater, Manatee, Barnes Sound	BMB	0.306	0.526	0.718	0.91

The scores were calculated for each zone and the zones were averaged to the sub-region scores.

Crocodiles

The American Crocodile (*Crocodylus acutus*), is monitored by the University of Florida with USGS and USFWS. The indicator scoring and thresholds (Table 61 and Table 62) are based on the stoplight indicator (Ecological Indicators Special Issue and System-wide reports).

Table 61: Crocodile stoplight indicator

Stoplight color bounds	Color
0-0.4	Red
>0.4-0.8	Yellow
>0.8-1	Green

Table 62: Crocodile thresholds

Stoplight bound	Report card score	Equation
0	0	y = 95x
0.2	19	y = 50x + 9
0.3	24	y = 100x - 6
0.4	34	y = 71.429x + 5.4286
0.47	39	y = 83.333x + 0.1667
0.53	44	y = 142.86x - 31.714
0.6	54	y = 71.429x + 11.143

0.67	59	y = 83.333x + 3.1667
0.73	64	y = 142.86x - 40.286
0.8	74	y = 100x - 6
0.85	79	y = 100x - 6
0.9	84	y = 200x - 96
0.95	94	y = 120x-20
1	100	y = 120x-20

In each area, the stoplight score was calculated and then converted to the report card scoring scale. Then the area scores were averaged to an overall crocodiles score for each water year.

Prey community structure

Prey community structure is an indicator measured in conjunction with the spoonbill nesting indicators. It is measured at six locations in the Taylor Slough and C-111 Basins. Thresholds are based on the stoplight indicator. The stoplight score is converted to the report card scoring scale (Table 60).

Table 60: Prey community structure thresholds

Stoplight	Report card score (%)	Equation
0	0	y = 4x
5	20	y = 4x
40	79	y = 1.6857x + 11.571
100	100	y = 0.35x + 65

Salinity

The Florida Bay Salinity Performance measure evaluates salinity conditions in six zones as described by Briceno and Boyer (2010). Using 17 stations in the Everglades National Park Marine Monitoring Network, a stoplight methodology categorizes salinity during the wet season (May through November) and dry season (December through April). The Florida Bay Salinity PM has 3 metrics that were used to arrive at an aggregate score. The three metrics are: (1) regime overlap, (2) mean offset, and (3) high salinity.

The regime overlap metric compares the distribution of salinities in the paleo-adjusted NSM record (target) to the observed or predicted distribution of results between the 25th and 75th percentiles (mid-range). This comparison provides a score between 0 and 1 with 1 meaning the observed or predicted distributions better match those of the target (higher overlap).

The mean offset metric is a measure of the magnitude that the observed/predicted output may deviate from the target. This metric calculates the absolute value of the difference between the target monthly (or seasonal) salinity mean and the observed (or predicted monthly (seasonal) salinity.

The high salinity metric focuses on the exceedances (in days) of the observed/predicted data above a high-salinity threshold (the 90th percentile value for the period of record for the paleo-adjusted NSM). Scores are calculated by dividing the number of days of exceedance in the observed/predicted data into the target exceedance. Scores range from 0 to 1 with 1 being the desired score. The "aggregated" metric normalizes the previous 3 metrics and averages them together to give a single value that reflects the overall match between the observed salinity and the salinity target for each station and zone. For further information on the Florida Bay Salinity PM and how it is used, please visit the following link: http://141.232.10.32/pm/recover/recover_docs/perf_measures/062812_rec_pm_scs_salinity_flbay.pdf.

The salinity indicator includes two of the metrics from the stoplight methodology: regime overlap and mean offset. These two metrics were scored for each station in the wet season and in the dry season. Then the two metrics were averaged into an overall salinity score.

Spoonbill nesting

Roseate spoonbills (*Platelea ajaja*), are monitored by Audubon Florida's Everglades Science Center in five regions in Florida Bay. The indicator includes five metrics: total nests in Florida Bay, number of nests in NE Florida Bay, number of nests in NW Florida Bay, nesting production and success in NE, and nesting production and success in NW. These metrics and the thresholds are based on the stoplight indicator.

For the total nests in Florida Bay metric, the exact stoplight results are used times 100. For the number of nests in NE Florida Bay the exact stoplight results are used times 100. For the number of nests in NW Florida Bay, the stoplight score is converted to the report card scoring scale (Table 57).

Table 57: Number of nests in NW Florida Bay thresholds

Stoplight	Report card score (%)	Equation
0	0	y = 0.1538x
130	20	y = 0.1538x
171	40	y = 0.4878x - 43.415
210	60	y = 0.5128x - 47.692
324	80	y = 0.1754x + 23.158

For nesting production and success in NE and NW, the stoplight scores for nesting production and the stoplight scores for nesting success are converted to the report card scoring scale (Table 58 and Table 59).

Table 58: Nesting production thresholds

Stoplight	Report card score (%)	Equation
0	0	y = 26.667x
0.75	20	y = 26.667x
1	40	y = 80x - 40
1.24	60	y = 83.333x - 43.333
1.38	80	y = 142.86x - 117.14

Table 59: Nesting success thresholds

Stoplight	Report card score (%)	Equation
0	0	y = 4.75x
4	19	y = 4.75x

6	79	y = 30x -101
10	100	y = 5.25x + 47.5

Instead of averaging the scores for production and success within NE or NW, the lower score is used. The five metric scores are equally averaged to the overall spoonbill nesting score each year.

Spotted seatrout

Juvenile spotted seatrout density is monitored by NOAA in four regions of Florida Bay: West, Whipray, Rankin, and Crocodile Dragover. The density is the number of individuals in $1000m^{-2}$. Thresholds are based on the stoplight indicator. At each location the population density is given a rating which is converted to the report card scoring scale (Table 56). The scores for each region are averaged to the overall spotted seatrout score per year.

Table 56: Spotted seatrout scoring scale

Rating	Score
Very good	100
Good	70
Fair	50
Poor	30
Very poor	0

Submerged aquatic vegetation

Submerged aquatic vegetation (SAV) abundance was monitored across Florida Bay in 19 total basins and summarized into five zones. Thresholds are based on the abundance index from the established Florida Bay SAV indicator which assesses the extent of seagrass coverage and the density of that coverage. The abundance index has three levels for the stoplight scale: 0, 1, and 2. The stoplight scale values are averaged by zone and then converted to the report card scoring scale which has five levels.

Southwest Coast Thresholds

Alligators

The American Alligator (*Alligator mississippiensis*), is monitored by the University of Florida with USGS and USFWS. The indicator scoring and thresholds (Table 64 and Table 65) are based on the stoplight indicator (Ecological Indicators Special Issue and System-wide reports).

Table 64: Alligator stoplight indicator

Stoplight color bounds	Color
0 - 0.4	Red
>0.4 - 0.8	Yellow
>0.8 - 1	Green

Table 65: Alligator thresholds

Stoplight bound	Report card score	Equation
0	0	y = 95x
0.2	19	y = 50x + 9
0.3	24	y = 100x - 6
0.4	34	y = 71.429x + 5.4286
0.47	39	y = 83.333x + 0.1667
0.53	44	y = 142.86x - 31.714
0.6	54	y = 71.429x + 11.143
0.67	59	y = 83.333x + 3.1667
0.73	64	y = 142.86x - 40.286
0.8	74	y = 100x - 6
0.85	79	y = 100x - 6
0.9	84	y = 200x - 96
0.95	94	y = 120x - 20
1	100	y = 120x - 20

In each area, the stoplight score was calculated and then converted to the report card scoring scale. Then the area scores were averaged to an overall score for each water year.

Chlorophyll a

Chlorophyll a monitoring is conducted by the Miami-Dade Department of Environmental Management (DERM), the South Florida Water Management District, and NOAA. Thresholds for the Mangrove Transition Zone sub-region are based on the stoplight thresholds from Boyer et al. (2009). The three stoplight intervals were converted to 5 even scoring intervals on a 0-100 scale. Calculations for these 5 intervals by linear regressions of report card scores as a function of quartile values (Table 63).

1) Very good, (dark green) regression between within 0 to 25th percentile range of the reference chlorophyll a distribution (0-20 points with linear interpolation between range endpoints).
2) Good (light green) for 25th to 50th percentile range as above.
3) Fair (yellow), poor (orange), and red intervals with regression of the interval from the 50th percentile to the 75th percentile values (including an arithmetic midpoint between the 50th% and 75th%, which does not affect the regression but demarks the yellow-orange boundary), representing 20 points per interval.
4) Poor (orange) being on the other side of this midpoint, from the midpoint to the 75th% value, representing 20 points.
5) Very poor (red) extrapolates from the 50th% to 75th% regression representing 20 points, and has a score of 0 at the x-axis intercept.

Thresholds for the Southwest Florida Shelf sub-region are from a reference period and developed by NOAA.

Table 63: Chlorophyll a quartile values

Sub-region	Zone	25th percentile	Median	Midpoint median to 75th percentile	75th percentile

Southwest Florida Shelf	SWFS	0.87002	1.466111	1.953	2.44
Mangrove Transition Zone	MTZ	1.69	2.863	3.883	4.903

The scores were calculated for each zone and the zones were averaged to the sub-region scores.

Fish Dynamics

Fish dynamics includes three metrics: common snook (*Centropomis undecimalis*), Florida largemouth bass (*Micropterus salmoides floridae*), and sunfishes (genus *Lepomis*). Monitoring is conducted by the FIU Coastal Fisheries Lab via electrofishing.

Thresholds are based on the relative proportion of the long term mean catch per unit effort (CPUE). A desired condition was established by calculating a long-term average abundance in the dry season over the 13 years of monitoring. The deviations from this long-term mean were evaluated across years for the three groups. The deviations were converted to the report card scoring scale. The three group scores were averaged to the overall fish dynamics score for each year.

Salinity

Salinity is measured in the Upper Southwest Coast, in the Ten Thousand Islands by the USGS. The threshold is based on requirements for oysters and is the percentage of time the salinity is between 14-28 ppt. Salinity scores are calculated for five regions by water year. This is the best current threshold even though the locations of the salinity sensors are upstream of where the oysters predominantly are (with the exception of the boundary site, which is more marine than typical oyster habitat). The ideal range of salinity would vary at each location, and could possibly be established in the future.

Scoring

Once thresholds have been identified, data are scored using either a pass/fail or multiple threshold method. Ideally, multiple thresholds are used to provide some gradation of results from poor to excellent, rather than just pass or fail, but this may not be appropriate for all indicators.

A pass/fail scoring method is a simple method used to calculate indicator scores based on whether or not an ecologically relevant threshold was met. The process outlined below uses dissolved oxygen as an example, and results are scored on a scale of 0 to 100%, where the higher percentage values represent more healthy conditions (Figure 2).

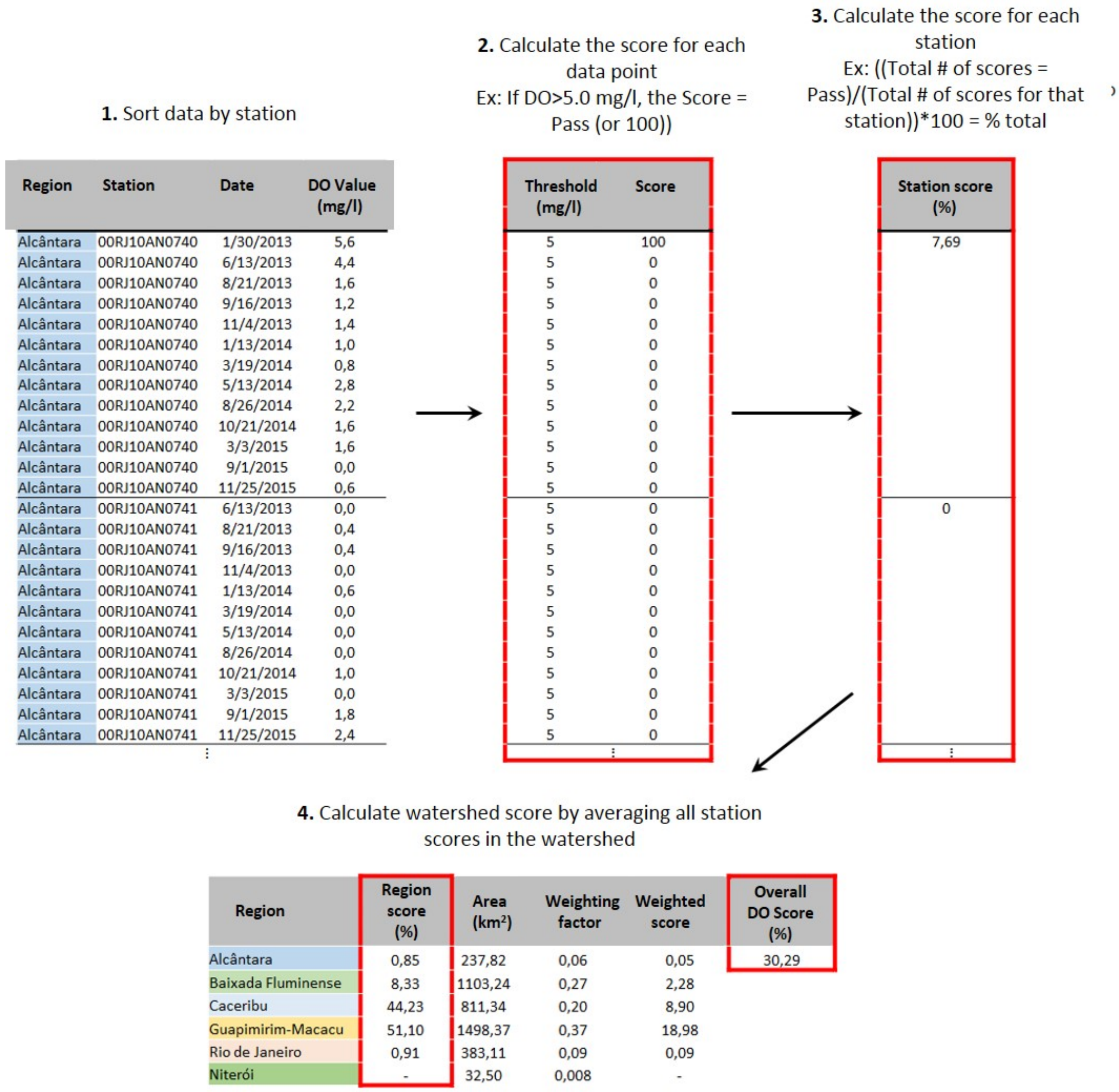


Figure 2: Example scoring method.

For the Everglades, all indicators were assessed through a pass/fail criteria or multiple threshold criteria. Once each indicator was compared to a pass/fail or multiple threshold scale and assigned a score, it was averaged into a station score. Then, each station score within a sub-region was averaged together to a sub-region score for that indicator. Each overall sub-region score is area-weighted into the overall score. An example of the scoring for the Basin is below. For all indicators, the scoring scale follows a 20-point scale of 0–100%, (Table 66).

Table 66: Scoring scale and description

Score (%)	Description
80-100	Very good
60-80	Good
40-60	Fair
20-40	Poor

0-20	Very poor

Final scores were divided to provide a clearer picture of health (Figure 3). This scale provides information about small improvements or declines in ecosystem health. This scale allows evaluation of small changes in ecosystem health, even at the very poor, and poor ranges.

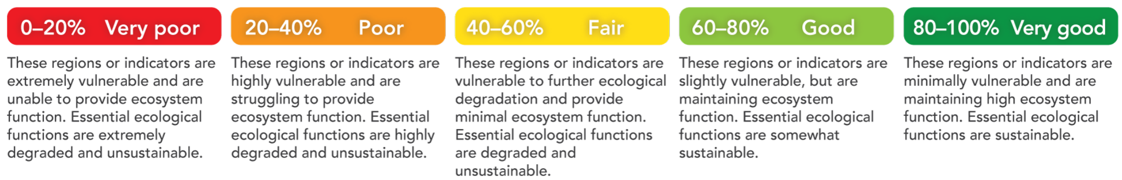


Figure 3: Scoring detailed descriptions

Quality Assurance/Quality Control

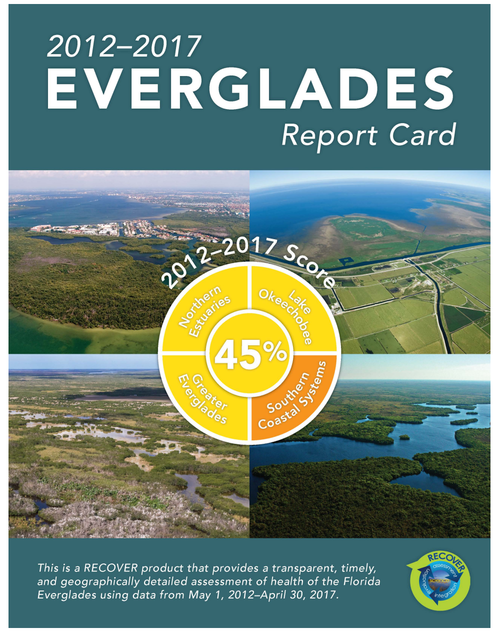
Data analysis QA/QC

After data are analyzed, a second person re-checks the data. All numbers are compared to original spreadsheets to make sure there are not any errors transferring data. All calculations are also checked, to make sure equations have been entered in correctly, and applied to the correct cells in the Excel spreadsheet. The current dataset is small enough to check every indicator and every calculation. As datasets become larger and more complex, a subset of data is checked. This is done by comparing the current year's indicator score to last year's indicator score. If the score is different by 33% (or a pre-determined amount) between one year and the next, those data are flagged and checked for accuracy. This can be completed during the production of the second Everglades Report Card. Having proper quality assurance and quality control methods is vital to maintaining the integrity of the data and consistency in the information reported.

Communication through a report card

Ecological report cards provide performance–driven numeric scores that represent the relative ecological health of a geographic region or component of the ecosystem. They are an important tool for integrating diverse data types into simple scores that can be communicated to decision makers and the general public. In other words, large and often complex amounts of information can be made understandable to a broad audience.

Ecological report cards enhance monitoring, management, and research in several ways. For monitoring, report cards justify continued monitoring by providing timely and relevant feedback to managers and can have the added benefit of accelerating data analyses. For management, they provide accountability by measuring the success of restoration efforts and identifying impaired regions or issues of ecological concern. This catalyzes improvements in ecosystem health through the development of peer pressure among local communities. Report cards also can guide restoration efforts by creating a targeting scheme for resource allocation. For the research community, they can lead to new insights through integration schemes that reveal patterns not immediately apparent, help to design a conceptual framework to integrate scientific understanding and environmental values, and help to develop scaling approaches that allow for comparison in time.



Ecosystem health assessments have become more common in recent years, and report cards are being produced by a variety of groups from small, community–based organizations to large partnerships. Although methods, presentation, and content of report cards vary, the underlying premise is the same: to build community awareness and raise the profile of health impairment issues and restoration efforts.

Some common elements of report cards include

1. A map of the watershed or region
2. A score stamp
3. The year(s) of the report card
4. A summary of the key features (e.g., ecosystem types, recreation activities)
5. A "What You Can Do" or what is occurring to improve conditions section

For the Everglades report card, numerous meetings were conducted to plan the content, layout, and design of the document. Many iterations of the report card occurred as the document evolved into its final state. The report card provides background information on the region, impacts to the ecosystems, information about the hydrology, projects occurring in the region and restoration activities, in addition to the methods and scores. This report card provides a much-needed synthesis of monitoring data being collected in the Everglades in a visually appealing and engaging manner (see image above). The Everglades report card includes the five basic elements listed above.

UNDERSTANDING SOUTH FLORIDA

Hydrology connects ecosystems in south Florida

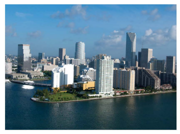
The Everglades encompasses **four regions interconnected by water**—the Northern Estuaries (Caloosahatchee River Estuary, Loxahatchee River Estuary, and St. Lucie River Estuary), Lake Okeechobee, the Greater Everglades, and the Southern Coastal Systems (Biscayne Bay, Florida Bay, and Southwest Coast). When people talk about the Everglades, they are usually thinking about the Greater Everglades. This is a vast freshwater wetland mosaic composed of sawgrass ridges, sloughs, tree islands, and marl prairie.

Historically, the Greater Everglades received water flowing out of Lake Okeechobee at its northern end and discharged water south into the Southern Coastal Systems. The Northern Estuaries were isolated from outflow from the lake. Urban development and drainage for agriculture have disrupted this pattern. Water that used to flow south out of Lake Okeechobee is now redirected into the St. Lucie and Caloosahatchee estuaries. The capacity of the freshwater wetlands to store water also has been lost.

These changes have degraded natural habitat needed by wildlife like fish and wading birds. Loss of water storage and connectivity diminishes options available to water managers to sustain natural ecosystems and satisfy the needs of south Florida residents for water supply and flood protection.

Restoration of the Everglades will improve conditions for both people and ecosystems and sustain the Everglades for generations to come. This is being done through numerous projects to improve conditions locally and through coordinated actions to improve conditions on a regional scale.

Tree island in the Greater Everglades region. Photo by SFWMD.



Development in south Florida has altered water flow and habitats. Photo by SFWMD.

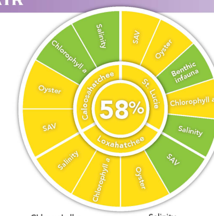
How was health calculated?

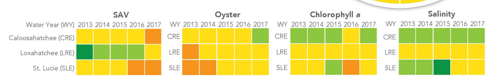
Environmental report cards are used by resource managers to assess and report on the ecosystem health of a region. Developing rigorous, quantitative assessments provides accountability to support environmental protection efforts. A five-step process of developing report cards is used to assess progress: 1) determine values and threats, 2) choose indicators, 3) define thresholds, 4) calculate scores, and 5) communicate results. This report card provides a transparent, timely, and geographically detailed assessment of health in the Everglades using data from May 1, 2012–April 30, 2017.

Everglades health is defined as the progress of region-specific indicators toward scientifically-derived thresholds, targets, or goals. The indicators for each region were developed by regional coordinators, principle investigators, and scientists with specific expertise in these regions. The indicators are combined into an overall region score for each of the four regions. These four region scores are area-weighted into an overall score for the entire Everglades system. The scoring system ranges from 0%–100%, with 100% as the best score, and 0% as the worst score. For more information on specific indicators, methodology, and scoring, please visit **evergladesecohealth.org**.

NORTHERN ESTUARIES: FAIR

In general, the Northern Estuaries (Caloosahatchee River Estuary, Loxahatchee River Estuary, and St. Lucie River Estuary) are in fair to good condition. Submerged aquatic vegetation (SAV) declined or remained stable at low densities in all regions. Oyster scores ranged from poor to good throughout the five years with mostly fair scores. A cycle of salinity perturbations negatively affected oysters, but when salinities were favorable the oysters rebounded. Benthic infauna were in good condition, while salinity and chlorophyll *a* were in good to fair condition. The Northern Estuaries are impacted by human control of flows that alter volume, distribution, circulation, and temporal patterns of freshwater inflows, and natural events like hurricanes, El Niño, and drought. These cause sub-optimal salinities that have negative impacts on SAV, oysters, and benthic infauna.

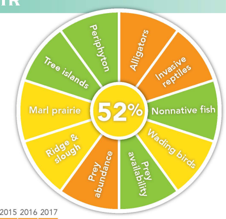


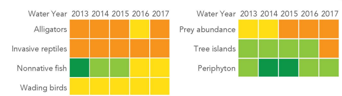


Select indicator scores by year from Water Years 2013–2017.

GREATER EVERGLADES: FAIR

In the Greater Everglades region, conditions varied throughout the five-year reporting period with indicator scores ranging from good to poor. Conditions for periphyton were good despite a shift in periphyton community structure. Tree islands were also in the good range due to resilience of the islands in conservation areas. Although nonnative fish had a good score overall, the score ranged from good to fair with more nonnatives in recent years. Invasive reptiles also continued to increase in number and expand their range, scoring poor overall. Multiple years of wet conditions impacted prey availability, and as a result, most wading bird targets were not met. Prey abundance and alligator indicators were impaired. Marl prairie and ridge and slough habitat were degraded; however some areas of marl prairie habitat have shown improvement.





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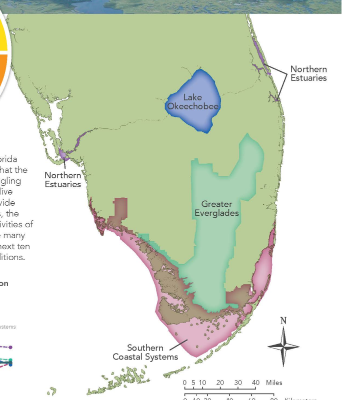
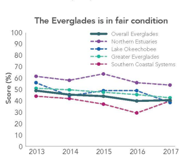


An overall score of 45%, fair, for the Florida Everglades is concerning. This means that the ecosystems of the Everglades are struggling to support the plants and animals that live there and the natural services they provide to people. Without healthy ecosystems, the economy, tourism, and recreational activities of south Florida suffer. However, there are many restoration projects scheduled for the next ten years that will help improve these conditions.



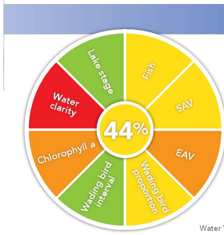
Everglades overall and region scores from Water Years 2013–2017 (May 1, 2012–April 30, 2017).

evergladesecohealth.org

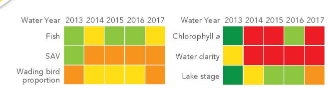
What do the scores mean?

0–20% Very poor	20–40% Poor	40–60% Fair	60–80% Good	80–100% Very good
These regions or indicators are extremely vulnerable and are unable to provide ecosystem function. Essential ecological functions are extremely degraded and unsustainable.	These regions or indicators are highly vulnerable and are struggling to provide ecosystem function. Essential ecological functions are highly degraded and unsustainable.	These regions or indicators are vulnerable to further ecological degradation and provide minimal ecosystem function. Essential ecological functions are degraded and unsustainable.	These regions or indicators are slightly vulnerable, but are maintaining ecosystem function. Essential ecological functions are somewhat sustainable.	These regions or indicators are minimally vulnerable and are maintaining high ecosystem function. Essential ecological functions are sustainable.

LAKE OKEECHOBEE: FAIR

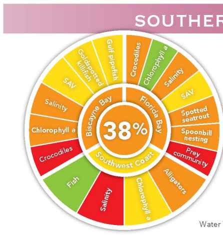


Indicators evaluated in Lake Okeechobee were fish, submerged aquatic vegetation (SAV), emergent aquatic vegetation (EAV), wading bird proportion (based on prey density), wading bird interval between exceptional nesting years, chlorophyll *a*, water clarity, and lake stage. Lake stages were close to desired targets, except for several high-water events during the peak of the summer growing season. These untimely exceedances may explain the difference between lake stage scores and those for flora and fauna. EAV and SAV were poor to fair, likely affecting fish and wading bird indicators; though the wading bird interval indicator scored well. Water clarity scores were very poor and chlorophyll *a* scores were poor, likely affecting SAV and fish indicators.

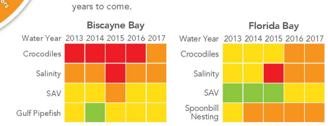


Select indicator scores by year from Water Years 2013–2017.

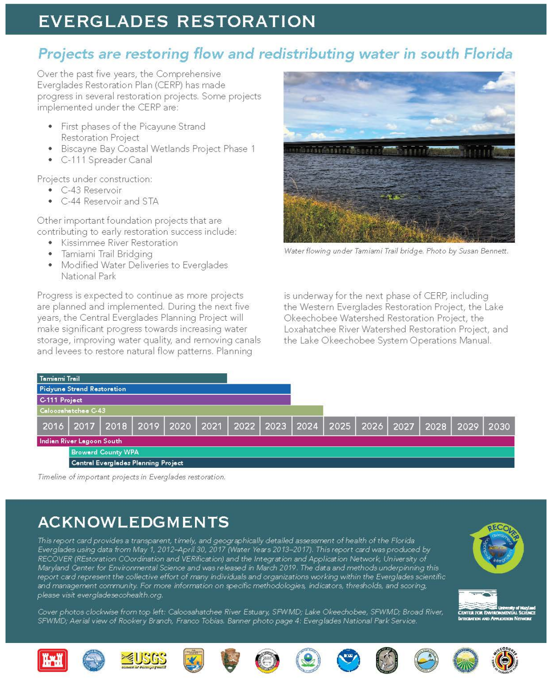
SOUTHERN COASTAL SYSTEMS: POOR



Overall, the Southern Coastal Systems regions (Biscayne Bay, Florida Bay, and the Southwest Coast) are in poor to fair condition. Reduced freshwater flow combined with sea level rise has resulted in increased salinity throughout the region. Elevated salinity, due to a local drought in 2014 and 2015, negatively impacted crocodiles, gulf pipefish, and submerged aquatic vegetation (SAV) in Biscayne Bay and Florida Bay. Spoonbill nesting, prey community, and spotted seatrout are in poor to very poor condition. Gold spotted killifish, gulf pipefish, and fish in the Southwest Coast region were in fair to good condition. To improve the ecological processes and overall health of the Southern Coastal Systems region, restoration of freshwater flow will need to continue in the years to come.



Select indicator scores in Biscayne Bay and Florida Bay by year from Water Years 2013–2017.


EVERGLADES RESTORATION

Projects are restoring flow and redistributing water in south Florida

Over the past five years, the Comprehensive Everglades Restoration Plan (CERP) has made progress in several restoration projects. Some projects implemented under the CERP are:

- First phases of the Picayune Strand Restoration Project
- Biscayne Bay Coastal Wetlands Project Phase 1
- C-111 Spreader Canal

Projects under construction:
- C-43 Reservoir
- C-44 Reservoir and STA

Other important foundation projects that are contributing to early restoration success include:
- Kissimmee River Restoration
- Tamiami Trail Bridging
- Modified Water Deliveries to Everglades National Park

Water flowing under Tamiami Trail bridge. Photo by Susan Bennett.

Progress is expected to continue as more projects are planned and implemented. During the next five years, the Central Everglades Planning Project will make significant progress towards increasing water storage, improving water quality, and removing canals and levees to restore natural flow patterns. Planning is underway for the next phase of CERP, including the Western Everglades Restoration Project, the Lake Okeechobee Watershed Restoration Project, the Loxahatchee River Watershed Restoration Project, and the Lake Okeechobee System Operations Manual.

Timeline of important projects in Everglades restoration.

ACKNOWLEDGMENTS

This report card provides a transparent, timely, and geographically detailed assessment of health of the Florida Everglades using data from May 1, 2012–April 30, 2017 (Water Years 2013–2017). This report card was produced by RECOVER (REstoration COordination and VERification) and the Integration and Application Network, University of Maryland Center for Environmental Science and was released in March 2019. The data and methods underpinning this report card represent the collective effort of many individuals and organizations working within the Everglades scientific and management community. For more information on specific methodologies, indicators, thresholds, and scoring, please visit evergladesecohealth.org.

Cover photos clockwise from top left: Caloosahatchee River Estuary, SFWMD; Lake Okeechobee, SFWMD; Broad River, SFWMD; Aerial view of Rookery Branch, Franco Tobias. Banner photo page 4: Everglades National Park Service.

Conclusions

Overall, the monitoring programs and resulting data collected in the Everglades provided an excellent base from which to produce a report card. The scores were synthesized into a public-friendly document that can inform and engage its readers. This is the first time this has been done for the Everglades, and as an added piece of synthesis to the 2019 System Status Report, it is vitally important.

The process of producing the report card, from the initial workshop to the final stages of the report card, was made possible by the collective efforts of RECOVER, the US Army Corps of Engineers (USACE), the South Florida Water Management District, many other organizations, and the Integration & Application Network, UMCES through funding by USACE. This effort cannot be understated in regards to completing an excellent product that is relevant, topical, and a useful communication tool.

It is recommended that the report card be updated regularly with continuous participation and inclusion of stakeholders in the Everglades in the development process. In future report cards, with increased sampling and new indicators measured, the integrity and quality of the data will increase and provide guidance for management actions towards the restoration of the Everglades.

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