



Periphyton Monitoring in Big Cypress National Preserve

Data Quality Standards

Natural Resource Report NPS/SFCN/NRR—2019/1913



**ON THIS PAGE**

Air plants (genus *Tillandsia*) dot the trunks of bald cypress trees (*Taxodium distichum*) located in a cypress dome near the Concho Billie Trail, Big Cypress National Preserve.

Photograph courtesy of South Florida/Caribbean Network, National Park Service.

ON THE COVER

Calcareous periphyton mats in Fire Prairie unit, Big Cypress National Preserve.

Photographs courtesy of South Florida/Caribbean Network, National Park Service

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Abstract

The purpose of this document is to outline the standards used by the South Florida/Caribbean Network (SFCN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in *Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative* (Urgelles 2019). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the South Florida/Caribbean Network and supplement the National Inventory and Monitoring Division Quality Management Plan (in prep). The plan also serves as a guide for all South Florida/Caribbean Network personnel who are involved in protocol or program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Introduction

The purpose of this document is to outline the standards used by the South Florida/Caribbean Network (SFCN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in *Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative* (Urgelles 2019). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the South Florida/Caribbean Network and supplement the National Inventory and Monitoring Division Quality Management Plan (in prep). The plan also serves as a guide for all South Florida/Caribbean Network personnel who are involved in protocol or program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

Periphyton is identified as a vital sign in the SFCN monitoring plan because of its sensitivity to environmental change. Periphyton is a microbial mat community that forms the base of the aquatic food web in South Florida wetlands such as the marshes in Everglades National Park (EVER) and Big Cypress National Preserve (BICY). It is a vital component of these wetlands, contributing to critical functions such as primary production, nutrient cycling, and soil production and stabilization. Periphyton is sensitive to slight changes in hydropattern (water quantity and duration) and water quality. Changes to these two ecosystem processes can quickly alter periphyton community structure (species composition and relative abundance), which in turn can create cascading effects on higher trophic levels. Periphyton is an early and integrative indicator of local and regional changes to hydrology, and is being used to monitor the success of Everglades Restoration for the Comprehensive Everglades Restoration Program (CERP).

In Big Cypress National Preserve, upstream development and agricultural runoff are altering the quantity and quality of the water entering the northwest portion of the preserve. There is concern that these hydrologic changes are adversely affecting the region's flora and fauna. Higher than normal water-column total phosphorus levels have been consistently recorded from water-quality stations routinely sampled from April 1994 through November 2010 in the preserve's northwest region.

Numerous studies in the adjacent Everglades National Park have linked water management and increased nutrient loading with immediate changes to the periphyton community. However, there has been little periphyton research conducted in Big Cypress National Preserve, especially in the prairie- and cypress-dome communities with a soft-water (water with little calcium or magnesium ions) source.

The South Florida/Caribbean Network is implementing monitoring of periphyton communities in the preserve to assess the impact of hydrologic and water quality changes on the changes in the diatom community structure and total phosphorus (TP) concentrations of the periphyton mat in northwestern Big Cypress National Preserve.

The specific monitoring objectives include:

- Identify any basins in the northwest section of Big Cypress National Preserve where periphyton community structure and periphyton TP content are different from an oligotrophic (low-nutrient) and unimpacted community signal.
- Document any temporal or spatial trends in the periphyton community structure and periphyton TP content showing progression towards an oligotrophic, unimpacted condition or a eutrophic (high-nutrient), impacted condition.

Due to financial limitations, the geographic scope is limited to monitoring periphyton in the northwest section of Big Cypress National Preserve, which had the greatest water-quality concerns for resource management. This section was divided into seven basins. Basins were designated based upon flow patterns and natural or non-natural barriers. The sampling design is a stratified restricted random design in which potential sampling sites are randomly selected within each basin. However, sites are restricted to those being safely accessible by road, trail or helicopter; contain a range of habitats from deeper broadleaf marsh to shallower graminoid habitat; and being no closer than 1 kilometer (0.62 miles [mi]; small basins) or 3 kilometers (1.9 mi; large basins) from another site in the same basin.

Field sampling involves navigating safely to the site, hiking toward the deeper broadleaf marsh habitat until periphyton is encountered, collecting a grab sample of the periphyton, taking three water depth measurements, taking water quality measurements (pH, dissolved oxygen, conductivity) using a YSI meter, and taking a series of photographs. A visual estimate of the vegetation composition is determined for a 5-meter (16.4-foot [ft]) radius circle measured from where the grab sample is collected. Sampling occurs at a location within 250 meters (820 ft) of the random point and along the ecotone between graminoid and broadleaf marsh.

Periphyton samples for diatom analysis are fixed with 3% formalin and then sent to a lab for counting the diatoms present. Periphyton samples for total phosphorus measurements are sent to a nearby lab as frozen samples.

When sample results are received from the labs, analyses are conducted using both ordination with all the data; and using simplified indices of the proportion of oligotrophic, mesotrophic, and eutrophic diatoms present, including the average total phosphorus content.

Protocol Activities and Modules

Data collected or derived as a part of this protocol (*Periphyton Monitoring in Big Cypress National Preserve* [Urgelles et al. 2019]), are described in 11 different activities or modules (Table 1).

Table 1. Protocol activity matrix for Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019).

Type	Activity and Number	Description
Site Recon, Establishment and Maintenance	1. Site Recon	Sites initially visited to determine if the appropriate habitat is present and whether site is safely feasible to reach either via helicopter, ATV, hiking, or airboat. A basic data sheet is filled out.
	2. Site Establishment	Site coordinates, extent of site, and logistics of access to site are documented. No physical markers are placed in the field.
Field Sample & Specimen Collection and Processing	3. Periphyton sample collection	Periphyton samples are collected using a grab sample, fixed (diatom samples) or frozen (total phosphorus samples) and sent to laboratories.
Field Observations	4. Habitat characterization	Visual estimate of vegetation composition and absolute percent vegetated and non-vegetated cover within 5-meter radius circle from grab sample location. Measurements of water depth using 1-meter stick at grab sample location, 1 meter closer to deeper broadleaf marsh, and 1 meter closer to shallower graminoid marsh.
Sensor Data	5. Physical water parameters (temperature, DO, pH, conductivity)	Collection of temperature, dissolved oxygen, pH, and conductivity using YSI meter at grab sample location or nearest point to grab sample with sufficient water for probe to function.
	6. Site Characterization Photos	Photos taken of data sheet, four cardinal directions, downward, and of collected sample at grab sample location.
Laboratory Data	7. Periphyton diatom samples	Periphyton grab samples are sent for laboratory analysis of diatom community composition. Lab returns lab slides plus diatom counts by species.
	8. Periphyton Total Phosphorus Samples	Periphyton grab samples for laboratory analysis of TP content. Lab returns TP analysis results of samples.
Derived Data	9. Diatom composition	Percent oligotrophic, mesotrophic, and eutrophic diatoms
Quality Control Data	10. Duplicate periphyton grab sample collection for diatom analysis	A duplicate sample from five sites will be sent to the lab for periphyton diatom analysis.
	11. Duplicate periphyton grab sample collection for TP analysis	A duplicate sample from five sites will be sent to the lab for periphyton mat TP analysis.

Sampling Design

Information regarding the sampling design is described in Table 2.

Table 2. Activity-level sample design matrix Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019).

Type	Activity and number	Sampling Design	Revisit Design
Field Sample & Specimen Collection	3. Periphyton sample collection	Probability: Permanent restricted random sites selected within each basin. Basins are defined using flow-ways and natural and man-made barriers. Exact grab sample location of periphyton sample at a site varies from year to year in contiguous wetland area within a 250 m radius of the randomly selected point; if possible within the same depressional wetland. Two people start at the access point and walk towards where the graminoid marsh to broadleaf marsh ecotone is located, looking for periphyton.	Annual
Field Observations	4. Habitat characterization	Probability: Same as activity 3. Vegetation characterized within 5 m of grab sample location, and water depth taken at three standardized points.	Annual
Sensor Data	5. DO, pH, Conductivity	Probability: Same as activity 3. Measurements taken at grab sample location or nearest point with enough water for the sensor.	Annual
	6. Photopoint data	Probability: Same as activity 3. Standardized series of photos taken from grab sample location.	Annual
Laboratory Data	7. Periphyton diatom identification and counts	Probability: From grab sample collected in activity 3, prepare a slide and identify the first 600 diatoms.	Annual
	8. Periphyton total phosphorus Samples	Probability: Homogenize grab sample from activity 3, analyze a 50 mL aliquot for total phosphorus.	Annual

Data Quality Objectives

Data quality values and standards for implementation are described in Table 3 through Table 7.

Table 3. Data quality values (DQVs) for Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019)

Quality	Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	Diatom identification and phosphorus analysis conducted at qualified labs. All sample locations are monitored following the schedule and methods outlined within Urgelles et al. (2019).
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Pilot tests showed little variability due to small changes in location within a sampling site (< 320 meters) and between marshes and nearby cypress domes compared with large differences due to basins with differing measured water quality total phosphorus (Urgelles et al. 2019).
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	All sample locations are monitored following the schedule and methods outlined within Urgelles et al. (2019).
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Data reports will be generated within six months of receiving results from laboratories. This may be up to 18 months after data collection.
	Completeness	All data/ measures required to evaluate accuracy representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	Data are collected according to methods outlined within Urgelles et al. (2019). Analysis is not contingent on having all sites collected in all years.

Table 3 (continued). Data quality values (DQVs) for Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019)

Quality	Data Quality Value	Definition	Protocol Considerations
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Datasheet and definitions are provided in Urgelles et al. (2019).
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	Data will be posted to the NPS Data Store .

Table 4. Measurement quality objectives for Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019).

Quality Type	Measure/Quality Indicator	Quality Objectives
Site Recon	Site selection criteria	Suitable access point exists within 250 meters of randomly generated location. Graminoid marsh-broadleaf marsh ecotone exists within 250 m. Consensus in conclusions between both staff regarding helicopter safe access, desired wetland community and safely accessible periphyton, absence of obvious cultural site or visitor use. Definitions of criteria identified in Urgelles et al. (2019). Helicopter pilot also must concur regarding safe access.
	Canopy Height	Trees $\pm$ 2 meters, Shrubs $\pm$ 1 meter, Herbaceous $\pm$ 1 meter
Site Establishment	Grab sample location selection	Most direct safe path is taken from access point to the graminoid marsh-broadleaf marsh ecotone within 250 meters of randomly generated location.
	Location Description Detail	Location on aerial imagery provided and mode of transportation: helicopter, hiking, ATV, or Airboat.
Periphyton sample collection	Location accuracy	$\pm$ 4 meters (GPS accuracy), and location is within 250 meters of randomly selected point within the same depressional feature.
Habitat characterization	Surface cover:	$\pm$ 10% per category; estimate is of absolute percent cover
	% Vegetation,	$\pm$ 10% per category; estimate is of absolute percent cover
	% Periphyton,	$\pm$ 10% per category; estimate is of absolute percent cover
	% Open water/bare	$\pm$ 10% per category; estimate is of absolute percent cover
	Absolute percent vegetation cover by species (six species max)	$\pm$ 10% per species; estimate is of absolute percent cover by species.
	Substrate type	Consensus in identification between both staff
	Substrate location	Consensus in identification between both staff
	Habitat Type	Consensus in identification between both staff
	Taxonomic Resolution	Identifications made to the species level
	Taxonomic Identification Accuracy	95% accuracy
	Taxonomic Identification Completeness	95% of observations made to species level for dominant species

Table 4 (continued). Measurement quality objectives for Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019).

Quality Type	Measure/Quality Indicator	Quality Objectives
Habitat characterization	Water depth	±5 centimeters
	ORV activity	Consensus in identification between both staff
Physical water parameters	pH	± 0.1 pH unit
	Conductivity	± 0.5% Full Scale or $\pm 1^\circ \mu\text{S}/\text{cm}$, whichever is greater (μS =microsiemens)
	Temperature	± 0.1 °C
	Water color	Within one color level on SRM (Standard Reference Method) chart to determine water color (see SFCN water color chart)
	Transparent to bottom	Consensus in identification between both staff
	Transparency depth (cm)	± 5 centimeters
Site Characterization photos	Image resolution	5 megapixel
	Image format	JPG
Periphyton Diatom Samples (Stevenson and Bahls 1999)	Taxonomic Resolution	Identifications made to the species or lowest taxonomic level possible
	Identification Accuracy	95% accuracy
	Identification Completeness	95% of observations made to species level
Periphyton Total Phosphorus Samples	Method detection limit	0.10 $\mu\text{g}/\text{g}$ - Method Name EPA 365.1 - Note: Practical Quantitation Limits (PQL) values are established equal to the lowest calibration standard of each analysis. Any reported value below PQL (S1) and Method of Detection Limits (MDL) will be flagged and considered uncertain, as per LOQ definition.
	Practical Quantitation Limit	3.87 $\mu\text{g}/\text{g}$

Table 5. Taxonomic standards to be used in Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019).

Data	Activity	Standard to be Used	Reference/Authority
Collection of Observational Data	Habitat characterization	Scientific Publication	Wunderlin and Hansen (2003)
	Periphyton Diatom Identification and Counts	Taxonomic Subject Matter Expert	Jan Stevenson, Michigan State University, following taxonomic reference USGS, BioData and tracking version used.
Reporting of Observational Data	Habitat Characterization	Scientific Publication	Wunderlin and Hansen (2003)
	Periphyton Diatom Identification and Counts	Taxonomic Subject Matter Expert	Jan Stevenson, Michigan State University

Table 6. Professional and laboratory accreditation requirements for *Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative* (Urgelles et al. 2019).

Type	Activity	Parameter	Accreditation Requirement	Location of Certification Documentation
Lab Accreditation	Periphyton total phosphorus analysis	TP (total phosphorus)	EPA	Florida International University—Southeast Environmental Research Center

Table 7. Data Protection standards for Periphyton Monitoring in Big Cypress National Preserve: Protocol Narrative (Urgelles et al. 2019).

Type of Information	Type of Data	Level of Protection	Rules for Dissemination
Personally Identifiable Information	Non-NPS Staff Information	Legally Protected	All but initials redacted from public release

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