



Wadeable Stream Suitability Assessment for Long-Term Monitoring

Kennesaw Mountain National Battlefield Park

Natural Resource Data Series NPS/SECN/NRDS—2018/1185



ON THE COVER

Looking downstream of the bridge on Noses Creek at Kennesaw Mountain National Battlefield Park. NPS photo / SECN

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Executive Summary

The Southeast Coast Network (SECN) initiated a monitoring effort to assess habitat conditions in wadeable streams at national parks, recreation areas, battlefields, and monuments in Alabama, Georgia, and South Carolina (McDonald et al. 2018a). These parks include Chattahoochee River National Recreation Area, Kennesaw Mountain National Battlefield Park, Congaree National Park, Horseshoe Bend National Military Park, and Ocmulgee National Monument.

The monitoring, implemented in 2016, focuses specifically on providing relevant data to assess the physical condition of Piedmont and upper Coastal Plain streams with respect to aquatic and riparian habitats and how these habitats may be changing over time. The habitat assessment methods outlined in the protocol rely on standard data collection methods and standard operating procedures currently in use by the U.S. Geological Survey, U.S. Environmental Protection Agency, and U.S. Forest Service that have been modified to better meet the needs of National Park Service (NPS) managers.

The Southeast Coast Network's Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks protocol (McDonald et al. 2018a) was developed to begin a monitoring program that will provide insight into the status of, and trends in, stream and riparian habitat conditions. The number of reaches surveyed at each park is dependent on the spatial extent of the park and the total number of wadeable streams that are present within park boundaries. Regardless of the size of the park and the number of reaches that are to be monitored, selected reaches (1) are representative of the processes influencing the streams in each park; (2) can address current and anticipated management concerns; and (3) offer the most utility for future complementary studies.

The purpose of this report is to document the stream suitability survey conducted at Kennesaw Mountain National Battlefield Park (KEMO). The purpose of this survey was to determine which streams should be chosen for long-term monitoring (McDonald et al. 2018a). On 7 February 2017, SECN staff met with Chief Ranger Anthony Winegar to determine which streams in the park are of management concern and are suitable for long-term monitoring. Stream segment suitability was based on whether the stream: (1) could be safely accessed; (2) is part of a single channel, wadeable stream system; and (3) is not greatly influenced by upstream impoundments.

Of the ten stream segments identified by a GIS analysis, four stream segments (two each on Noses Creek and Ward Creek) were determined to be of potential management concern (Figure 1). After evaluating the stream segments in the field, three of the segments (two on Noses Creek and one on Ward Creek) were determined to be suitable for long-term monitoring. The remaining segment (Upper Ward Creek) was determined to not be suitable for long-term monitoring (Table 1). The upstream stream segment on Ward Creek was determined not to be suitable because this portion of Ward Creek has been highly modified by the installation of a sewage line. Upper Ward Creek is now a multi-channel quasi-wetland and the SECN wadeable stream monitoring protocol was not developed to monitor multi-channel streams (McDonald et al. 2018a).

Following an analysis of the basin characteristics of the three suitable stream segments and in consultation with park staff, one segment on Noses Creek and one segment on Ward Creek were chosen for long-term monitoring (Table 2). The two stream segments chosen provide comparisons between similar streams and will help determine if the upstream trails or bridges on these streams are having a downstream influence. The following report provides an overview of the methods used to assess the suitability of each stream segment and provides a description of how the monitored reaches within each stream segment will be compared in future reports.

Introduction

The purpose of this report is to document the stream suitability survey that was conducted at Kennesaw Mountain NBP to determine which streams should be chosen for long-term monitoring (McDonald et al. 2018a). On 7 February 2017, SECN staff met with Chief Ranger Anthony Winegar to determine which streams in the park are of management concern and are suitable for long-term monitoring. Stream segment suitability was based on whether the stream: (1) could be safely accessed; (2) is part of a single channel, wadeable stream system; and (3) is not greatly influenced by upstream impoundments.

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similar streams and will help determine if the upstream trails or bridges on these streams are having a downstream influence within the park. The following report provides an overview of the methods used to assess the suitability of each stream segment and provides a description of how the monitored reaches within each stream segment will be compared in future reports.

Kennesaw Mountain National Battlefield Park

Kennesaw Mountain NBP consists of approximately 3,000 acres (1,214 hectares [ha]) of mixed hardwood pine forest and open fields. The park is located within the Atlanta metropolitan area in the Allatoona Mountain range (Figure 1). Kennesaw Mountain itself is located in the northern portion of the park and receives approximately 2.6 million visitors per year. Water resources include some small bog wetlands and mountain seeps (less than 10% of the area) and two perennial streams. These relatively small third-order streams, Noses Creek and John Ward Creek, originate outside the park boundaries and drain mostly urban and suburban areas prior to flowing through the park. Due to the intense urban and suburban development outside the park, the hydrology of these streams has been substantially altered and exhibits typical flashy flows consistent with urban streams (Gregory and Calhoun 2007; Gregory et al. 2012; Starkey 2015). The heavy visitor loads and popularity of horseback riding on trails throughout this urban park have created areas where stream bank erosion is a potential management concern (Stan Bond, former Park Superintendent, personal communication).

Methods and Results

Stream segments were chosen for long-term monitoring based on GIS analyses of relevant, reliable, and accurate data layers, their relevance to management concerns, and based on field assessments of their safety and accessibility. Field evaluations are necessary because the resolution of available geospatial data is often too imprecise for a determination of the suitability of any given sample reach. In order to provide the most relevant information for management, stream reaches are either: (1) paired (based on drainage area and stream type) to determine the influence of different upstream watershed characteristics and land use/land cover; or (2) chosen to represent conditions or processes affecting similar-sized streams within the park. A probabilistic approach to reach selection was not used due to the limited number of stream segments within the park.

Stream segments were selected for long-term monitoring in five stages:

1. identification of potential stream segments in GIS;
2. consultation with park staff;
3. field suitability evaluation;
4. basin-scale assessment in GIS; and
5. final decision (with park staff input).

Each of these stages is discussed in detail in McDonald et al. (2018a) and step-by-step instructions are provided in SOP 1.2.14 *Wadeable Stream Reach Selection and Location of Sampling Points—Version 1.0* (McDonald et al. 2018b). A brief description of each stage and the results of the each analysis is provided below.

Identification of Potential Stream Segments in GIS

Potential stream segments were identified in a GIS using the National Hydrography Dataset high definition (NHDhd) dataset and the park ownership boundaries. A point coverage was created to represent the potential stream segments within the park. This point coverage was used to discuss potential survey reaches with park staff as well as locate the stream segments in the field. All stream segments were classified as perennial, were within park ownership boundaries, and each segment was at least 400 feet (122 meters [m]) in length. A total of 10 perennial stream segments were identified within the boundaries of Kennesaw Mountain NBP (Figure 1).

Consultation with Park Staff

Once all of the potentially wadeable stream segments were identified, SECN staff met with the park's Chief Ranger Anthony Winegar to: (1) identify reaches with current or potential management concerns; (2) determine issues that may prevent accessing the segment; and (3) determine the long-term applicability of each stream segment. During the meeting, six stream segments were discarded because they were not of management concern (Table 1). The four remaining potentially suitable stream segments (two on Noses Creek and two on Ward Creek) were then evaluated in the field.

Field Suitability Evaluation

Field surveys were conducted on each potentially suitable stream segment to determine its suitability for long-term monitoring. Additionally, a potential reach within the candidate segment was identified which was representative of the stream segment. The width, water depth, and bank height characteristics of the stream and an interpretation of the geomorphic conditions that characterize the segment were recorded. Additionally, any conditions that made the stream unsuitable for sampling were also recorded. Conditions that make a stream segment unsuitable for sampling include (but are not limited to): presence of beaver dams or ponds; lack of a defined channel; or hazardous conditions such as treacherous wading conditions or difficult access to the stream (high undercut banks).

The field suitability evaluation determined that three of the four stream segments (k004, k005, and k009) were suitable for long-term monitoring. The upstream Ward Creek segment (k008) was determined to not be suitable for long-term monitoring because of the sewage line that runs through this portion of the park. The disturbance created by the sewage line coupled with beaver activity has turned this portion of Ward Creek into a quasi-wetland, multi-channel system that does not fall into the sampling frame outlined in the requirements of the SECN wadeable stream monitoring protocol (McDonald et al. 2018a).

Basin-Scale Assessment in GIS

A basin analysis was conducted to characterize the watershed characteristics (i.e., geomorphic basin characteristics and land cover conditions) of the three stream segments classified as suitable for long-term monitoring (Table 2). This stage of segment selection determined the basin-scale similarities between segments. This was done so that paired

segments could be selected and representative segments could be chosen that provide an understanding of similar streams in the park. The measures used to determine the geomorphic and land cover conditions represented by each stream segment are described in McDonald et al. (2018a) and detailed methods to calculate these measures can be found in SOP 1.2.15 *Wadeable Stream Basin- and Segment-Scale Data Summary—Version 1.0* (McDonald et al. 2018c).

Final Decision

The results of the basin-scale assessment were used to assist in the final selection of stream segments. Southeast Coast Network personnel made the final stream segment selection by assessing reach utility, safety, and suitability issues. Chosen stream segments struck a balance between being relevant to management goals, being complementary to future studies, and were representative of conditions within the park.

Of the three suitable stream segments, Noses Creek downstream (k005) and Ward Creek mid (k009) were chosen for long-term monitoring. These two sites were chosen because they are both downstream of a bridge or trail crossing and are near (non-official) social trails. These two sites will be compared in future reports to determine if the differences in basin characteristics are contributing to statistically significant differences between the two streams. The Noses Creek upstream segment (k004) was not chosen because the evaluated segment was not optimal (stream is eroding into valley walls on river left) and the network only has enough resources to monitor two segments during this survey cycle. It is recommended that an additional site is installed upstream of the bridge on Noses Creek to serve as a control site for the downstream site and help determine the influence the trails downstream of the bridge are having on the creek.

Table 1. List of all of the wadeable stream segments at Kennesaw Mountain NBP assessed during the winter of 2017.

pSite	Stream Name	Management Concern	Suitable	Latitude	Longitude	Stream Order	Drainage Area (km ²)
k001	Unnamed	No	—	33.984	-84.589	1	0.6
k002	Unnamed	No	—	33.972	-84.597	1	1.5
k003	Unnamed	No	—	33.958	-84.601	1	3.3
k004	Noses Creek (Up)	Yes	Yes	33.955	-84.595	3	7.9
k005	Noses Creek (Dn)	Yes	Yes	33.953	-84.600	3	8.5
k006	Unnamed	No	—	33.942	-84.604	1	0.3
k007	Unnamed	No	—	33.929	-84.598	1	0.9
k008	Ward Creek (Up)	Yes	No	33.927	-84.590	3	12.8
k009	Ward Creek (Mid)	Yes	Yes	33.926	-84.591	3	13.6
k016	Ward Creek (Dn)	No	—	33.920	-84.606	3	17.5

Table 2. Stream segments that were chosen for monitoring. The final site numbers were determined after consultation with park staff. Pairs refers to how the reaches will be compared (and potential additional pairing if an additional site is added) in the annual and synthesis reports.

pSite	Site Name	Stream Name	Stream Order	Drainage Area (km ²)	Entire Stream Gradient (%)	Basin Slope (°)	Basin Relief (km)	Developed (%)	Forested (%)	Grass/Pasture (%)	Pairs
k004 ^a	—	Noses Creek (Up)	3	7.9	0.0134	6.72	0.257	50	47	3	(2)
k005	KEMO001	Noses Creek (Dn)	3	8.5	0.0125	6.69	0.260	47	49	3	1 (2)
k009	KEMO002	Ward Creek (Mid)	3	13.6	0.0081	4.52	0.088	69	29	1	1

^ak004 was not initially chosen to be monitored. However, in future consultations with the park, if it is deemed of interest, this site may be included in future monitoring.

Kennesaw Mountain National Battlefield Park - Potential Stream Monitoring Sites

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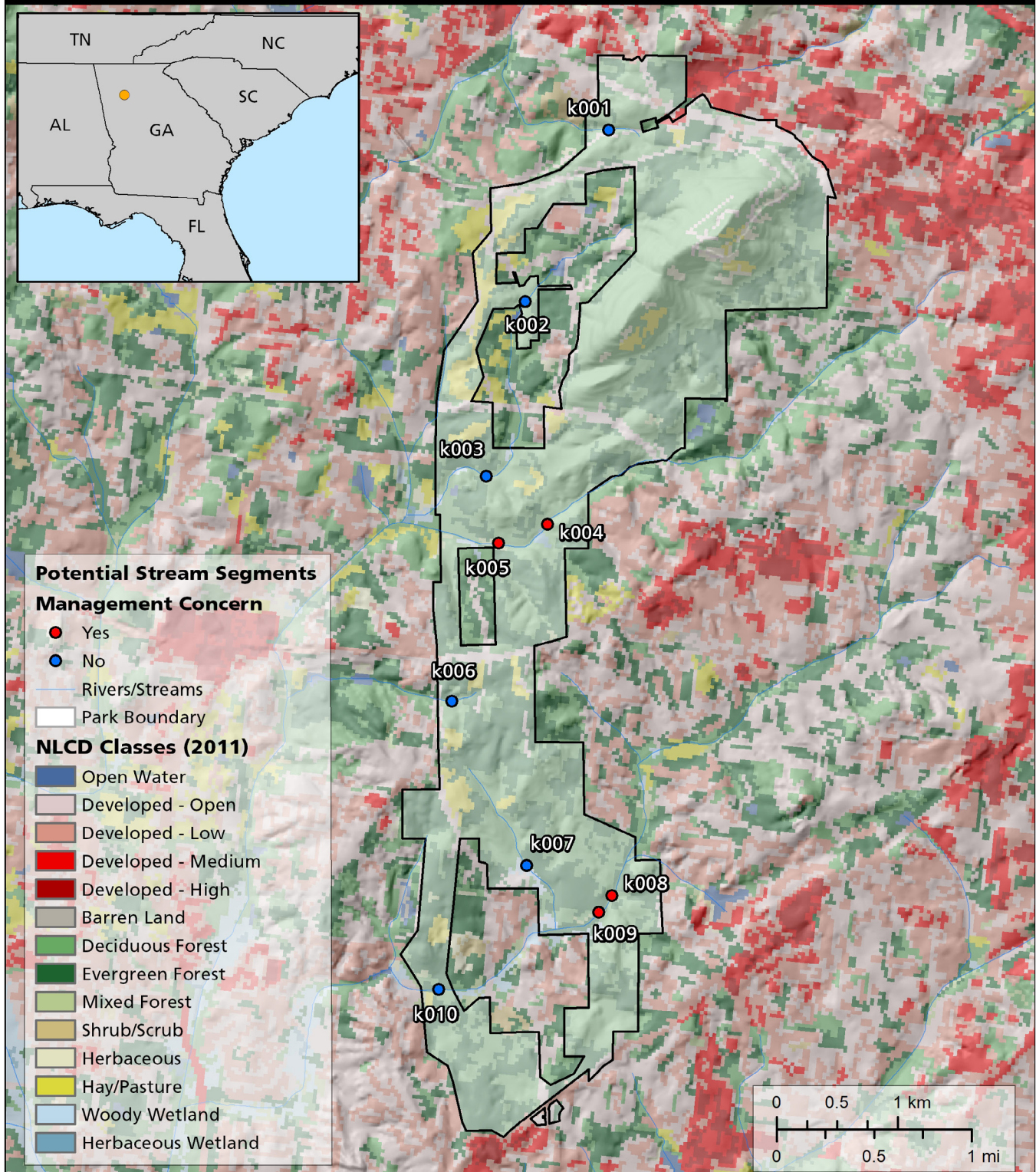


Figure 1. Overview map of the stream segments that were assessed to determine their suitability for long-term monitoring according to the criteria outlined in the SECN wadeable stream monitoring protocol (McDonald et al. 2018).

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