

Vegetation Monitoring Protocol

Cumberland Piedmont Network

Standard Operating Procedure (SOP) # 1

SOP 1: Field Season Preparation

Version 3 (March 2017)

Revision History Log:

Previous Version #	Date	Revised by	Changes	New Version #
1.0	01/15/12	B. Moore and R. White	Minor editorial changes adding clarification following 2011 field season; formatted for publication in NRR series	1.1
1.1	9/26/12	B. Moore and R. White	Minor editorial changes to reduce confusion after 2012 field season.	1.2
1.2	3/28/17	C. Bledsoe	Made additions to SOP to incorporate plot revisits.	1.3

Overview

This SOP describes preparations for the field season and includes a list of necessary equipment. Preparations should be completed by the start of training in late April/early May. Staff should review by March of each year and revise any sections based on lessons learned from the previous year.

Staffing

The vegetation monitoring protocol will be implemented by two teams (typically one field crew leader and one or two crew members per team, although teams can include up to four people) covering a total of 14 weeks during April-September each year. At least two team members should possess good identification skills for woody plants and have experience in forest sampling methods. At least one team member should be able to identify herbaceous and graminoid plants of the southeastern United States. Other desirable expertise includes knowledge of exotic plants, forest pests, ozone injury, pathogens, and soils. Implementation of the protocol will also require use of cameras, GPS units, compasses, and other field tools (see equipment list).

It is the Network Program Manager's responsibility to ensure qualified field staff are assigned/hired prior to April of each year. Student Conservation Associates (SCAs), university interns, and other cooperators will assist through various cooperative agreements available to the CUPN.

Communication & Coordination with Parks

A current NPS research permit is required for each park scheduled for vegetation monitoring. The permits should be completed in January of each year (if possible, permits should be requested for 2 years to cut down on the amount of paperwork from year to year). Some parks allow multi-year permits to cover long-term monitoring projects, while others require annual renewal. The status of vegetation monitoring research permits and applications for new permits is available at the NPS Research Permit and Reporting System website (<http://science.nature.nps.gov/research>). The Network Manager will ensure that each park has the current Vegetation Monitoring Protocol and a map of sampling locations so that any compliance issues can be addressed. All plot and tree marking procedures and any soil disturbance activities must be cleared with park managers prior to plot establishment. The project lead will be responsible for year-end reporting to NPS for each active permit as required by the National Park Service.

In addition to permits, the key park contact at each park should be emailed two weeks prior to each trip as a reminder that vegetation crews will be out sampling. When possible, crews should stop by the Visitor Center or other park office for brief introductions and to meet any logistical needs such as picking up keys, hang tags etc. Park staff or interns may be interested in this project and are encouraged to join crews for at least one plot to learn more about monitoring. Follow-up trip reports should be completed within two weeks of each return trip.

Schedule and Training

Begin field crew training in late April/early May. Training will last one week and will consist of formal training for the first day followed by work on real plots for the rest of the week (table 1.1). In future revisits of plots, revisits should be timed to be within two weeks of the original plot establishment month and day so that resamples are taken at the same point in the growing season. Training will take place at CHCH because it is the first park to be sampled every year. Thus, any park-specific training materials such as species lists and vegetation community keys will be focused on CHCH.

Training should include demonstration and practice of all measurement procedures. The critical importance of careful, accurate, and steady data collection to this long-term monitoring program must be emphasized. Trainers must stress the importance of exact adherence to SOP instructions to prevent bias in measurements among years. Lack of strict adherence to protocols will inhibit our ability to detect long-term trends. The field team leader should encourage trainees to discuss with their supervisors any concerns that arise over field procedures, the datasheets, or the database during training or later during the field season. The crew should never deviate from established protocols or alter the datasheet or database without first consulting with their supervisor. Any changes in procedures must be clearly documented in the SOP revision history, and the project database. Once plot revisits begin, additions/changes to SOPs to accommodate plot revisits should be reviewed thoroughly before training takes place.

Training must emphasize the critical importance of careful plot behavior to minimize plot trampling. On steep slopes, in wetlands, or on plots with thick herbaceous or moss cover, all workers should place and unload packs outside the plot boundary, not within. Crew members should plan ahead and retrieve all gear for a particular set of measurements at one time, rather than taking extra trips across the plot. Crew members should minimize steps on the transects,

especially in or near the eight nested subplots. Appendix C (SOPs) is organized chronologically to assist field crews in making sure that each step in the field methods is the most efficient and least likely to trample by bundling all data collection to be done in a particular part of the plot together.

Training will include an overview of safety issues that may be encountered by field crews. This session will include what to do when encountering potential hazards such as challenging terrain (cliffs, steep slopes), weather (storms/heat), challenging driving scenarios (backcountry/heavy tourist areas), harmful insects (ticks/yellowjackets), and poison ivy.

Following is a sample training schedule for CHCH during plot establishment years that can be modified for use each year:

Training Week Schedule

One Week Prior

Send out fully revised SOPs, species codes list for all species found at CHCH, and a list of all materials that participants need to bring to training.

Packet to be compiled for training week should include:

- Full list of vascular plant species for CHCH (including checklist for trees and shrubs and 7 letter codes with 8 letter code exceptions highlighted)
- Park-specific ecological community key for CHCH
- Laminated sheets with tree status definitions, tree vigor definitions, tree dieback notes (with pictures?), decay class codes sheet, and sample diagram of a typical plot with information on which of the nested subplots get sampled
- Invasive Species Early Detection list for network and for CHCH
- “Cheatsheet” on rules for locating and establishing plots (during plot establishment years only)
- “Cheatsheet” for laying out a plot (one version for new plots and one for resampled plots)
- Datasheets, park contact list, and other items to be included in training packet

Day One

- 8:30 Welcome to the park
Hand out field packets for this park (these will include printed park map with all plots marked, printout of GRTS data points with space for comments and showing next available point in case of elimination).
- 8:45 Safety discussion (review and sign Job Hazard Analysis)
Key points:
-Accessibility and decisionmaking on when to abandon attempts to do a plot
-Communicating with park (procedures for checking in with park staff)
-Accessing plots (where can we drive and park the car)
-Weather issues (what to do in a thunderstorm)
-Specific information about yellow jackets and what to do when nests are encountered.
-Team logistics and what to do if you have to throw out a point.
-Other safety issues (ticks, snakes, etc.)

9:30 Review of plot sheets and SOPs with special emphasis on species nomenclature and canopy densiometer.

- Overview of methods including team member responsibility review. Which tasks should each team member need to be most familiar with? What focused reading of the SOP should they be doing?
- When to throw out a plot, move a point, or adjust size/shape of plot (and what to do about nested subplots when they fall on a rock or tree)
- SOP 1-3 with special emphasis on taking slope and aspect data
- SOP 4 emphasizing technique for taking photo of plot sheet before taking photo to easily capture plot number and date
- SOP 5 including a “dry run” on how to use canopy densitometer and laser rangefinder
- SOP 6 including measuring DBH
- SOP 7 and 8 with special emphasis on how to measure DBH of CWD
- SOP 9 use of veg classification keys
- SOP 10 procedures for soils collection
- Handling vouchers – tips and tricks to make life easier back in the office
- Method for collecting and labeling specimens that are likely to be vouchered while in the field – very important
- Data QA/QC (rechecking data before leaving field)
- Project QA/QC related to revisiting some plots.
- Documenting forest pests and invasive exotic plants
- Review on how to split up tasks by team member
- Filling out field reports once back in the office

12:00 LUNCH

1:00 Field exercise at first plot which includes taking real data. Special emphasis on 1) making sure each person uses densiometer to measure canopy closure, 2) compass or clinometers to measure slope and aspect, and 3) estimating cover values for species in plot. Also, all participants will fill out “disturbance” section. All measurements are compared to one another so that we can talk about ways to calibrate amongst ourselves. If time allows, go to second plot to talk about plot layout and repeat exercise on canopy closure and compass/clinometers use.

Goal = 1 plot

Day 2

8:00 Skills test and/or discussion for canopy densiometer, compass/clinometers, and disturbance.

9:00 Split up into two teams and begin to take plot data on two separate plots (team lead will ideally float between both groups during the first plot’s data collection to answer any questions or observe any variability in data collection).

12:00 Lunch together followed by completion of one more plot for the day.

Goal = 3 plots

Day 3

8:00 Each team will collect data on 2 plots.

Goal = 4 plots

Day 4

8:00 Complete all plot data. Review data taken from plots that were sampled twice right away to determine if there are any large discrepancies in the data collected between two field teams.

Noon Wrap up and lessons learned

Final specimen handling

Goal = 2 Qa/Qc plots

Day 5

If plots left to complete, then a team will stay behind to complete the last plot(s).

Table 1.1. Estimated schedule for fieldwork by month and week.

Park	Week	Park	Week
CHCH	May Week 1	STRI	July Week 2
LIRI	May Week 2	NISI	July Week 3
RUCA	May Week 3	CARL	Aug Week 1
GUCO	June Week 1	FODO	Aug Week 2
SHIL	June Week 2	CUGA	Aug Week 4
COWP	June Week 3	MACA	Sept Week 2
KIMO	June Week 4	ABLI	Sept Week 3

Table 1.1 Note *LIRI/RUCA, COWP/KIMO, and MACA/ABLI may be combined for one 10 day session rather than two separate weeks for more efficient work if that is preferable for those involved in the fieldwork.

Logistics

Once the year's schedule has been set, the team leads should reserve a CUPN vehicle or rental car for transport to and within parks. For most parks, plots can be accessed via a standard car and reasonable hiking, though in some cases transportation assistance may be needed. For example, at CUGA and LIRI a few plots may require a four wheel drive vehicle, ATV, and/or an overnight camping trip. At MACA, boats along the Green River may be important to ensure efficient access to all plots. Park contacts need to be notified well in advance to allow for assistance with these needs.

The network program manager will attempt to reserve park lodging where available as soon as the field season is set each year. If no park lodging is available, nearby commercial lodging within government rates will be pursued by either the program manager or field crew leader. Wherever possible, lodging should include kitchen facilities and high speed internet access.

Maps

Prior to each field season, maps will be prepared showing the year's sampling locations at each park relative to any plots from past years. One map should show all plot locations and some alternate locations in plot establishment years (in case some of the plot locations need to be thrown out). These plot locations should be overlaid on the USGS topographical maps, with roads, trails, and park boundaries included. A second map should show all plot locations overlaid on the most current aerial photography, with roads, trails, and park boundaries included. Line and point symbols for roads, streams, plots, and other features should be clearly visible but not large enough to obscure other features. Include a scale on all maps showing distances in meters or kilometers. We've found that overlaying a grid on the map with UTM coordinates in the outer margins helps a great deal in navigation. If the park is large enough, a smaller park-wide location map inset will be added to show where in the park the plot is located. All field maps will be printed on waterproof marine paper / Rite-In-Rain paper using a color LaserJet printer (inkjet printing does not adhere well to Rite-in-Rain paper). Finally, a printed out spreadsheet of each plot location for that year will be made with X and Y coordinates in UTM NAD83, with UTM zone for each park, just in case those X/Y coordinates are needed.

Crews will be supplied with additional maps as needed and where available. For example, some parks have National Geographic foldable, water-resistant maps or other similar fine scale maps with trail information to help facilitate navigation.

When establishing the plots for the first time, maps should be sent at least one month in advance of field work to key park staff and these staff should be asked if they see any problems with the location of any new plots that the team plans on establishing for that field season. If any plots are clearly centered directly on a large road, managed old field, building, pond, etc. they should immediately be thrown out and replaced by the next point not already assigned for sampling on the list of points (see discussion about this in main report for specifics on criteria for throwing out plots). However, if there is doubt as to whether the point is centered directly in one of these areas or not, then the point will be kept and field crews will decide whether to keep it or throw it out upon their first visit to the site. When planning for plot revisits, maps will contain established plot locations from the plot establishment year.

Other Key Materials

- List of all vascular plant species in the park with their corresponding 7-8 letter code.
- List of all tree species in park.
- "Cheatsheet" with list of all plant species that have the same first 4 letters of genus and first three letters of species.
- Ecological community key for the park.
- Laminated sheets with tree status definitions, tree vigor definitions, tree dieback notes/pictures, decay class codes sheet, and sample diagram of a typical plot with information on which of the nested subplots get sampled.
- Information on forest pests and exotic plants.

GPS Setup

Using DNR Garmin or other similar software, the GIS specialist will upload plot coordinates into the CUPN GPS unit(s) and/or handheld device (see the Using the Global Positioning System

SOP and the link to the DNR Garmin website:

<http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRCGarmin/DNRCGarmin.html>).

Immediately after uploading the plot coordinates, it is critical to check the GPS map page to ensure that the plot locations are shown correctly and are in the correct projection. One easy way to check that the points loaded properly is to navigate manually to the park in the GPS's map function and see if the points line up approximately with where they should be based on landmarks such as highways and towns. Although not perfect, this method will help field crews avoid gross projection errors that may place the plot locations in a different state or hemisphere. During plot revisits, coordinates from the established plots will be compared to the original plot coordinates to check for errors in GPS reception/user error.

Quality Control Points Preparation

Each year, 5% of the plots, will be selected for repeat visits to ensure consistency in plot data collection across the network. This will occur at parks where enough staff are available to conduct the repeat visits (usually CHCH and MACA). Some points that are particularly difficult to access may be excluded from the points chosen, but otherwise this will be done randomly. Field crews measuring the plots will not be informed as to which plots were chosen. Instead, a separate field crew will be asked to go back and resample some of the key measures within the plot within 2 weeks of the first team's sample. The list of resampled plots will be given to the Network Program Manager, so logistics can be arranged separately from the regular plot work and so that the field crew that measured the plot originally does not know that it is one of the quality control points. Once completed the duplicate plot results will be compared to initial results to identify any differences that are deemed significant. If any large differences occur, then actions may range from better training the following field season for the measure that showed the largest differences to "disqualification" of the data for those measurements in that year so that the data is not used in trend analyses.

Communication and Crew Oversight

The crew should carry a NPS radio when traveling in remote areas of parks when required by park policy or where cell phone coverage is spotty. In all other situations, carrying park radios will be optional. Radios should be programmed to the appropriate frequencies for each park. Crew members should know which frequencies to use, how to contact park radio dispatch, and be familiar with proper radio etiquette. In parks with cell phone coverage, crew members will be encouraged to carry a cell phone in the field for safety and to call their supervisor concerning protocol questions, although this is by no means required. It is essential for the crew to maintain regular contact with CUPN staff throughout the field season. Establish a regular weekly telephone call time between each team leader and supervisors to review the week's work. The update should cover questions or problems related to plots, protocol, logistics, and scheduling. The CUPN Program Manager and any other supervisors should try to join field teams at least once during the field season to directly observe data collection procedures.

Within 1-2 weeks of end of field week, a 1-2 page summary of the work completed at the park will be forwarded on to the park land manager and/or superintendent as a trip report. These summaries should not take more than 30 minutes to 1 hour to complete and will mainly rely on the anecdotal experiences of the field crew (interesting plants seen, plots visited, etc.).

Contracts

If soil samples are taken in a particular year, CUPN will select an experienced forest soils chemistry laboratory, and have a purchase order or other contract in place for soil sample analysis. Several soil laboratories have sufficient capabilities and have capacity to quickly analyze samples, including the labs used by the Carolina Vegetation Survey (Brookside Labs in New Knoxville, Ohio). The Network Manager will make a final decision about the lab to be used to analyze samples during the summer of each year.

Review of Yearly Staff Roles

Timing and staff roles are presented in Table 1.2.

Table 1.2. List of protocol tasks, responsible staff, and schedule.

Task	Staff	Timing
Finalize field schedule for crews	Project Leader	January
Reserve in-park housing for field crews for parks (where that opportunity exists)	Project Leader	January
Establish and refine annual and seasonal budgets	Project Leader/Network Program Manager (NPM)	January
Acquire the appropriate permits	Project Leader	February
Hire seasonal field crew if any are needed	NPM/Project Leader	February
Prepare, repair, and/or purchase equipment	Field Crew Leader	March
Confirm with park managers the correct method for permanently marking plots (some parks may want to opt out of conduit)	Project Leader	March
Randomly select 5% plots for QAQC	GIS Specialist/NPM	April
Identify who will be taking QAQC data for the year	NPM/Project Leader	April
Prepare database and datasheets for the field season (review species lists, add crew members names, etc.)	Project Leader / Data Manager	April
Compile training and field packet that includes maps of all points, coordinates of points, species lists, and datasheets.	Project Leader, NPM, Early Detection Leads, GIS Specialist	April
Arrange and conduct field crew training	Field Crew Leader	May
Coordinate directly with park resource managers when conducting field work in each park (call at least two weeks in advance to confirm field work dates and one month in advance to arrange for assistance from park personnel in transportation, logistics, etc.).	Field Crew Leader and NPM	May – Sept
Identify plants accurately and/or process unknown plants for later identification	Field Crew Leader	Ongoing
Participate in field season and oversee field crew during field season, providing logistic and administrative support	Field Crew Leader	Ongoing
Ensure plot work meets quality standards	Field Crew Leader	Ongoing
Ensure adequate numbers of plots are	Field Crew Leader	Ongoing

Task	Staff	Timing
established and/or measured each season at each park		
Ensure effective communication between park staff, field crew, and other CUPN staff	Field Crew Leader	Ongoing
Enter all data into master database as soon as practicable after data is taken.	Data Manager Crew Members Data Intern	Ongoing
Review and revise monitoring protocol and standard operating procedures on a yearly basis	Project Leader	November
Conduct data verification on 10% of forms once data from hardcopy forms are entered into database (exact methods to be determined as part of database development)	Data Manager Crew Members Data Intern	November
Conduct data validation after records are entered into database	Project Leader	November
Assure datasets and specimens are processed according to NPS guidelines	Curatorial Specialist	November
Compare QAQC data to original data for the 5% of plots that were resampled during field season.	Project Leader	November
Data analysis and report writing	Project Leader	November-December
Submit summary reports to permit reporting system for each active permit	Field Crew Leader	December

Supplies & Equipment

Required equipment and supplies for vegetation monitoring are listed below. Equipment should be organized and maintained in good working condition. At the end of each season the crew leader will inventory the condition of all equipment and prepare a list of required repairs or replacements. Mark each piece of equipment with a piece of brightly colored flagging to assist with locating it on the forest floor during data collection. Order any new supplies required for work by February. Especially, plan for having enough 12” long pieces of aluminum conduit and other hard-to-get items.

Table 1.3. CUPN seasonal vegetation monitoring supplies and equipment check list.

General:	Check
Master binder for each team containing:	
• List of park contacts (including phone numbers), park UTM zones, and declinations	
• Park permit	
• Paper list of all plots to be visited with UTM coordinates	
• Map(s) showing all primary plot locations and alternate locations overlaid on the USGS topographical maps, with roads, trails, and park boundaries included.	
• A secondary map showing plot locations overlaid on aerial photography with roads	
• Park maps and/or park brochures with roads and trails if available	
• Master Plant List for park	
• Park-specific ecological community key	
• Laminated sheets with tree data definitions, tree DBH irregularities, techniques for	

measuring stand height, and sample diagram of a typical plot with information on which of the nested subplots get sampled (for establishment years).	
ISED list for all parks, species information for specific park, and blank incidental observations sheets	
ICMS plant specimen information sheet for new-to-park plants	
CUPN emergency contact information sheet and directions to hospitals for each park	
Plot Datasheets:	
For plot establishment years:	
Set of blank plot datasheets on regular paper x 10	
Set of blank plot datasheets (Rite in The Rain) x 5	
Extras of pg. 1 (x3), pg. 6 (x3), pg. 9 (x5), pg. 12 (x5)	
For plot revisit years:	
Set of plot datasheets on regular paper printed from directly from database for 8 plots	
Set of inserts for plot datasheets x 8 (pgs. 7, 10, 11, 12, 13, 15)	
Set of blank plot datasheets (Rite in The Rain) x 2	
Extras of pg. 2 (x5), pg. 6 (x3), pg. 9 (x5), pg. 12 (x5)	
Other:	
Colored flagging	
Pencils	
Black industrial "Sharpie" markers	
Binder or paper clips (to keep plot data sheets together)	
Ziploc bags (keep items dry, general storage, etc.)	
Most recent protocol SOPs in binder	
Road maps and/or state Gazetteers for park region	
Early detection plant and pest flip cards for CUPN	
Plot Establishment:	
For plot establishment years:	
12" long aluminum conduit x7 per plot (good idea to pack 1 or 2 extra)	
Blue anodized numbered tree tags x2 per plot	
Nails (2 per plot)	
For plot revisit years:	
12" long aluminum conduit x10	
Blue anodized numbered tree tags x10	
Nails x10	
Clinometer	
At least 4 50-m tapes	
Chaining pins (i.e., surveyor's steel arrows) x8	
Pin flags x10	
Pillow Case – <i>for transport of conduit in pack</i>	
Hammer with prongs	
Digital camera and charger	
SD (secure digital) card	
Plot Measurement:	
Enclosed clipboard (1 per team member)	
Spherical densiometer (concave model)	
Laser range finder	
DBH tape x 2	

Meter sticks x2	
Biltmore stick	
Trees of the SE United States-Duncan and Duncan	
Preferred field guide to herbaceous species (optional)	
Compact, waterproof binoculars (8x) for viewing canopy tree leaves	
10x hand lens	
Plastic bags for plant samples (large Ziploc, 2.5 gallon)	
Wildflower identification guides (preference of data collectors)	
In Soil Collection Years:	
Sturdy trowel	
Sampling square for soil measurements	
Bunny soil knife or keyhole saw for soil measurements	
Clippers	
Sealable gallon-sized plastic bags for soil samples (3 per plot)	
Other:	
Lanyard	
Insect vials (collection of potential forest pests) x2	
Plant press and newspapers	
Each Crew Member should bring:	
Water and food for each day in field	
Daypack	
Sunscreen	
Hat (recommended)	
Rain gear including rain coat and rain pants (recommended)	
Brightly colored field vests (optional)	

References

Perles, S., J. Finley, and M. Marshall. 2010. Vegetation and soil monitoring protocol for the Eastern Rivers and Mountains Network, Version 2. Natural Resource Report NPS/ERMN/NRR-2010/183. National Park Service. Fort Collins, Colorado.