

Cumberland Piedmont Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 1

Field Season Preparation—Version 1.53

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Overview

This standard operating procedure (SOP) describes preparations for the field season including fieldwork planning, annual field crew training, safety concerns, and equipment needs. The CUPN's forest vegetation monitoring field season begins each year at Chickamauga and Chattanooga National Military Park over the course of the last few days in April and the first few days in May. This week typically serves as a time of training for core field season personnel. As such, updates to SOPs and other field season preparations should be completed before this time.

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Staffing

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

It is the network program manager's responsibility to ensure qualified field staff are assigned/hired prior to April of each year. Student Conservation Association interns (SCAs), university interns, and other cooperators will assist through various cooperative agreements available to the Cumberland Piedmont Network. Botanical expertise (i.e., field crew botanists) are also obtained annually via agreements or contracts, as appropriate. Park housing for seasonal employees can be arranged, as needed, at Mammoth Cave National Park by the network program manager.

Communication and Coordination with Parks

A current NPS research permit is required for each park scheduled for monitoring. The permits should be completed in January of each year (if possible, permits should be requested for 3–5 years, depending on each park's monitoring cycle, 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 request annual renewal. The status of forest vegetation monitoring research permits and applications for new permits is available at the [NPS Research Permit and Reporting System website](https://irma.nps.gov/RPRS) (<https://irma.nps.gov/RPRS>). The network program manager will ensure each park has the current protocol and a map of sampling locations so 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 protocol lead will be responsible for year-end reporting to NPS for each active permit as required.

In addition to permits, the key contact at each park should be emailed two weeks prior to each trip as a reminder that vegetation crews will be sampling. When possible, crews should stop by the Visitor Center or other park office for brief introductions and to address any logistical needs such as picking up keys or hang tags. 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 and participate in field sampling based on their level of training and experience. Follow-up trip reports should be completed within a month of each return trip.

Fieldwork Schedule

Fieldwork begins in late April or early May of each year. Depending on the year within the five-year sampling cycle or panel, three to 14 parks are sampled during the field season. All parks are sampled in years 1–3, and only the larger parks are sampled in years 4–5. Years 1 and 2 are full implementation years with at least eight plots sampled at each of the 14 network parks (Mammoth Cave NP has 12 plots sampled each year). All 14 parks are sampled in year 3 but the number of plots sampled at seven parks is reduced. In years 4 and 5 the number of parks sampled is reduced to six and three respectively (Table 1).

Table 1. Cumberland Piedmont Network’s five-year sampling schedule: Number of plots sampled per park and year.

Park Code	Park Name	Year 1	Year 2	Year 3	Year 4	Year 5	Total
ABLI	Abraham Lincoln Birthplace National Historical Park	8	8	4	4	–	24
CARL	Carl Sandburg Home National Historic Site	8	8	4	–	–	20
CHCH	Chickamauga and Chattanooga National Military Park	8	8	8	8	8	40
COWP	Cowpens National Battlefield	8	8	4	–	–	20
CUGA	Cumberland Gap National Historical Park	8	8	8	8	8	40
FODO	Fort Donelson National Battlefield	8	8	8	4	–	28
GUCO	Guilford Courthouse National Military Park	8	8	4	–	–	20
KIMO	Kings Mountain National Military Park	8	8	8	–	–	24
LIRI	Little River Canyon National Preserve	8	8	8	8	–	32
MACA	Mammoth Cave National Park	12	12	12	12	12	60
NISI	Ninety Six National Historic Site	8	8	4	–	–	20
RUCA	Russell Cave National Monument	8	8	4	–	–	20
SHIL	Shiloh National Military Park	8	8	8	–	–	24
STRI	Stones River National Battlefield	8	8	4	–	–	20
–	Total	116	116	88	44	28	392

Assuming a crew completes on average two plots per day, 58 sampling days are estimated in years 1 and 2, with this estimate decreasing in years 3–5. While weather, travel time to a plot and general plot complexity will sometimes alter the schedule, in most cases a single crew is able to complete sampling at a park within a single work week, though in many cases this is longer than a 40-hour

week. A second crew is typically utilized at both Mammoth Cave National Park and Cumberland Gap National Historical Park because Mammoth Cave NP has 12 plots on the schedule each year and Cumberland Gap NHP's long hikes can often result in a crew only completing a single plot per day.

Because plots span seven states, travel time to parks is also an important consideration, particularly in years 1–3. If a crew member stationed at Mammoth Cave NP travels to each of the parks in the network in these years, an additional 15 days needs to be added to the field schedule to account for travel time. Depending on park and plot selections, QA/QC will add an additional one to five field sampling days and up to five travel days to the overall workload estimates for a field season.

Fieldwork will always follow a certain order and timeframe of parks being sampled, with work beginning at Chickamauga and Chattanooga National Military Park every field season (Table 2).

Table 2. Approximate schedule for fieldwork by month and week.

Park	Week
Chickamauga and Chattanooga National Military Park (CHCH)	May Week 1
Little River Canyon National Preserve (LIRI)	May Week 2
Russell Cave National Monument (RUCA)	May Week 3
Guilford Courthouse National Military Park (GUCO)	June Week 1
Shiloh National Military Park (SHIL)	June Week 2
Cowpens National Battlefield (COWP)	June Week 3
Kings Mountain National Military Park (KIMO)	June Week 4
Stones River National Battlefield (STRI)	July Week 2
Ninety Six National Historic Site (NISI)	July Week 3
Carl Sandburg Home National Historic Site (CARL)	Aug Week 1
Fort Donelson National Battlefield (FODO)	Aug Week 2
Cumberland Gap National Historical Park (CUGA)	Aug Week 3
Mammoth Cave National Park (MACA)	Sept Week 2
Abraham Lincoln Birthplace National Historical Park (ABLI)	Sept Week 3

*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.

Training

Training includes 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 will 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 the protocol lead. Any changes in procedures must be clearly documented in the SOP revision history, and the project database. Once plot revisits begin, additions or changes to SOPs to accommodate plot revisits must be reviewed thoroughly before training takes place. Prior to training, SOPs with updates resulting from the previous field season's operational review will be sent out to all field crew members with adequate time for review before training begins.

Training must emphasize the critical importance of careful plot behavior to minimize plot trampling. The importance of not modifying plot attributes such as trimming back limbs, removing logs or rocks or pulling of exotic plants should also be stressed. While these actions may have good intentions (e.g., make it easier to collect plot data or exotics are unwanted), they can have substantial implications on the ability to make inference on the data collected from these permanent plots. 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 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. Training will focus on field methodology, which is primarily SOPs 3–9. Safety will also be an important topic, as well as pertinent issues arising from the previous season's operational review.

Training will begin with a discussion of the documents brought to each park in a “field binder” that field teams will utilize as they complete plotwork. These items are detailed further in this SOP. Training will also include an overview of safety issues encountered by field crews which will conclude with the review and signing of the current field season's Job Hazard Analysis (JHA). This session will address potential hazards such as:

- Navigating challenging terrain (cliffs, steep slopes)
- Working in extreme weather conditions (storms, heat, humidity)
- Encountering harmful animals (ticks, yellow jackets, snakes)
- Encountering harmful plants (poison ivy)
- Safety discussion (review and sign Job Hazard Analysis)

Additional topics covered during training will typically include:

- Updates to plot datasheets since previous field season
- Updates to field SOPs since previous field season

- Deviations from field SOPs during previous field season
- Commonly encountered errors found during previous field season's data entry, verification, and validation steps
- Identifying and documenting evidence of forest pests when measuring trees
- Documenting early detection invasive species

Additionally, an interim field season training or check-in will be scheduled to discuss, among other topics, an overview of field data collection issues. This session, most likely conducted via teleconference, at a minimum, will include the protocol lead, data entry staff and those involved in data collection.

Logistics

Once the year's schedule has been set, the protocol lead will 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 Cumberland Gap National Historical Park and Little River Canyon National Preserve, a few plots may require a four-wheel drive vehicle, ATV, or an overnight camping trip. At Mammoth Cave National Park, boats along the Green and Nolin Rivers 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 the protocol lead. Wherever possible, lodging will include kitchen facilities and high-speed internet access.

Maps

At least two weeks prior to visiting each park, field maps will be made available to the protocol lead for review. GIS projects for each park will be maintained on the CUPN server to help facilitate this review. During plot establishment years, maps will include alternate locations, in case some of the plot locations need to be thrown out. These plot locations are overlaid on the best available base maps, such as USGS topographical maps or park brochure maps with useful 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, and a scale on all maps showing distances in meters or kilometers should be included. 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 or Rite-In-Rain paper using a color LaserJet printer (inkjet printing does not adhere well to Rite-in-Rain paper). Crews may also 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.

Before a plot is established at a particular location, maps will be sent at least one month in advance of fieldwork to key park staff to see 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 or pond, they should be discarded and replaced by the next point not already assigned for sampling on the list of points. Refer to SOP 3 *Site Selection and Plot Establishment—Version 1.48* (CUPN 2023a), for additional details. 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.

GPS Setup

Prior to each field season, the CUPN GIS specialist will upload all the field season’s plot coordinates for each park into a GPS unit and backup unit. Refer to SOP 2 *Using GPS (Based on the use of GPSMAP 64)—Version 1.26* (CUPN 2023b) for additional details. Points will also be loaded on tablets with Avenza Maps (mobile map app) to aid in field navigation.

Quality Control

Each year, approximately 5% of plots scheduled to be sampled that year will be selected for repeat sampling to ensure consistency in plot data collection across the network (Table 3).

Table 3. Number of QA/QC parks and number of QA/QC plots that will be conducted each sampling year.

Year	Regular Sampling Effort: Parks	Regular Sampling Effort: Plots	QA/QC Sampling Effort: Parks	QA/QC Sampling Effort: Plots
1	14	116	3	6
2	14	116	3	6
3	14	88	2	4
4	6	44	1	2
5	3	28	1	2

Prior to the beginning of each field season, the network program manager will randomly select parks where QA/QC will be conducted for that season. Parks will be selected from the randomized order with the following two stipulations in years where QA/QC will occur at multiple parks:

- At least one QA/QC park will occur in the early part of the field season (i.e., May and June) and at least one will occur in the latter part of the field season (July–September)

- QA/QC will not be conducted at back-to-back parks in the sampling schedule (Table 2).

Separating the QA/QC parks will aid in ensuring protocol drift does not occur over the course of the field season. Spreading out the timing of QA/QC will also make it easier to secure and schedule a QA/QC crew.

Two QA/QC plots will be conducted at each park selected for QA/QC sampling. Plot selection within a given park will be randomized with the following potential exceptions:

- Plots that are difficult to access, requiring specialized training (e.g., motorboat operator certification) or experience beyond the demonstrated abilities of available crew.
- Plots that require private land access or need other park assistance.
- Plots on steep slopes or otherwise considered uniquely susceptible to resource damage in the opinion of the protocol lead or park staff.
- Plots that are a monoculture of exotics (at or near cover class 9).

On occasion, a selected plot may be vetoed “last minute” by the crew due to safety concerns (e.g., requiring an unanticipated highwater crossing). In those instances, the next plot on the randomized list will be selected. If such a veto occurs, it will be documented in the season’s operational review.

Field crews measuring the plots will not be informed in advance as to which parks or plots were chosen for QA/QC. The one exception to this rule is the protocol lead, who will need to be involved in the scheduling of teams and coordination with the parks for the QA/QC sampling effort. The QA/QC events will be scheduled to occur within two weeks of the regularly scheduled sampling event. Depending on park and plot selections, QA/QC will add one to five field sampling days and up to five travel days to the overall workload estimates for a field season.

The QA/QC team will include a botanist capable of identifying all woody and herbaceous plants on the plot, and at least one network staff member who is well versed on the forest protocol. The QA/QC team can include crew members that participated in the regularly scheduled sampling event, but these crew members must not participate in the same data collection tasks in both sampling events. For example, if a crew member collects coarse woody debris data during the regular sampling event then this crew member will not collect coarse woody debris data for the QA/QC event.

Except for potential safety concerns, no data sharing or generalized knowledge of the plot will be shared between the two crews. Because plot layout is one potential source of variability, each team will run their own set of tapes and retrieve all temporary plot/subplot markers at the conclusion of their sampling event, though flags can remain in the plot corners and plot center to speed the re-location of these permanent markers for the second field crew. A preliminary review of QA/QC plot results will be made as soon as practicable following completion of the QA/QC plot. Ideally, though not always possible, this would occur while the field crews are still present at the park. At minimum, the following comparisons will be made:

- Plot Attributes—Discrepancies in disturbance codes, stand height and canopy cover
- Tree—Discrepancies in species identification, diameter at breast height (DBH), counts and damage codes
- Herb—Discrepancies in species identification, cover values and counts of species (multiple scales)
- Seedling/Sapling—Discrepancies in species identification and counts within height classes
- Coarse Woody Debris—Discrepancies in counts and DBH (sum)
- U.S. National Vegetation Classification—Agreement/Disagreement

Ultimately, QA/QC results will be evaluated against established standards (SOP 11 *Data Quality Assurance and Quality Control—Version 2.1* [CUPN 2023c]). Data entry of QA/QC plots will be prioritized during the field season to make in-season corrections via discussion or ad hoc training. If any substantive differences occur, then additional 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 are not used in analyses.

Communication and Crew Oversight

Crews should always have two independent means of communication when traveling to remote sites. The crew carries an NPS radio when traveling in remote areas of parks when required by park policy or where cell phone coverage is spotty. Radios will be programmed to the appropriate frequencies for each park. Crew members must 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. In remote parks where cell phones are used and radios are not, a satellite communicator (e.g., InReach) is a recommended backup communication method. When working in remote areas, crews will check-in with CUPN or park staff daily (more often if deemed necessary) to ensure the safety of field crews. More remote parks typically have two field crews that check in with one another throughout the day (cell phone). Some parks also request that field crews check in with them at the end of each day when the crew is back at their vehicle or camp.

Crews are encouraged to contact the protocol lead concerning protocol questions. 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 will cover questions or problems related to plots, protocol, logistics, and scheduling. The CUPN network program manager and any other supervisors will try to join field teams at least once during the field season to directly observe data collection procedures.

Within one month of the completion of fieldwork, a one to two page summary of the work completed at the park will be forwarded to the park resource manager 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).

Review of Yearly Staff Roles

Timing and staff roles are presented in Table 4.

Table 4. List of protocol tasks, responsible staff, and schedule.

Task	Staff	Timing
Establish and refine annual and seasonal budgets	Network Program Manager (NPM), Protocol Lead	December
Identify QAQC parks and finalize field schedule	Protocol Lead	January
Acquire the appropriate permits	Protocol Lead	January
Hire/schedule seasonal field crew as needed	NPM, Protocol Lead	January
Oversee preparation, repair, and/or purchase of equipment	Protocol Lead	March
Prepare database and datasheets for the field season (review species lists, plot directions, etc.)	Protocol Lead, Data Manager	April
Compile training and field packet that includes maps of all points, coordinates of points, species lists, and datasheets	Multiple CUPN staff	April
Arrange and conduct field crew training	Protocol Lead, Other CUPN staff	April or May
Coordinate with park resource managers when conducting field work in each park (call/email 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.)	Protocol Lead Field Crew Leader	April–Sept
Identify plants accurately and/or process unknown plants for later identification	Field Crew Botanist	Ongoing
Participate in field season and oversee field crew during field season, providing logistic and administrative support	Protocol Lead	Ongoing
Ensure plot work meets quality standards	Protocol Lead, Field Crew Leader, Field Crew Members	Ongoing
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 are collected	Data Technician	Ongoing

Task	Staff	Timing
Compare QAQC data to original data as QA/QC plots are completed during field season	Protocol Lead	Ongoing
Conduct data verification on 100% of forms once data from hardcopy forms are entered into database and initial verification steps are complete	Data Technician, Data Manager, Other CUPN Staff	Ongoing
Conduct operational review and revise SOPs as necessary	Protocol Lead, Data Manager, Field Crew Members	
Conduct data validation after records are entered into database	Protocol Lead	November– January
Ensure datasets and specimens are processed according to NPS guidelines	Protocol Lead, Data Manager, Curatorial Specialist	December
Submit summary reports to permit reporting system for each active permit	Protocol Lead	December
Data analysis and report writing	Protocol Lead, Data Manager	January– March

Supplies and Equipment

Required equipment and supplies for forest vegetation monitoring are listed below. Equipment must be organized and maintained in good working condition. At the end of each season the protocol lead 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 or tape to assist with locating it on the forest floor during data collection. Order any new supplies required for work by March. Especially, plan for having enough 12-inch (30.5 centimeters [cm]) long pieces of aluminum conduit and other hard-to-get items.

For parks where two teams are used, each team will need its own set of equipment. Equipment brought to each park will be kept in a large sturdy tub for vehicle transport and individual items taken to plots will be removed from the tubs and carried to plots by field crew members.

The field binder, file folder, and tablet computer will be prepared with specific materials by CUPN staff before each week of fieldwork so field crews will have them ready to place in the tubs for transport to parks. These items and the specific materials pertaining to them are listed below:

1. Field binder

a. Required items

- i. Park-approved current research permit for park
- ii. Spreadsheet of plots to be sampled at the park (including information on plot location, and for revisit plots information on previous travel time to plot, previous plot sampling time, previous plot taxa count, and previous directions to plot)
- iii. Plot field maps for the park (including alternate plot locations during plot establishment years)
- iv. Annually updated compass declinations for all parks
- v. Annually updated full list of vascular plant species known to the park
- vi. Park-specific vegetation community key
- vii. CUPN Incidental Observation forms for invasive exotic plants, forest pests, or rare/tracked plant species encountered during fieldwork
- viii. Plant specimen forms for new-to-park plant species found at the park during fieldwork
- ix. Annually updated contact lists for all CUPN parks
- x. Directions to nearest hospital for all CUPN parks

b. Additionally, several other documents may be added to the field binder as needed. These are subject to change and have included:

- i. USDA and APHIS pest alerts for various invasive pest species as needed
- ii. Codes used for recording tree measurements with abbreviated definitions
- iii. Snag and coarse woody debris decay class chart
- iv. Definitions of irregularities in measuring tree diameters with diagrams
- v. Techniques for measuring stand height on both flat and sloping ground, using a clinometer and tape measure
- vi. Diagram of a typical plot with information on which of the nested subplots get sampled
- vii. Rules for locating and establishing plots (during plot establishment years)

- viii. Instructions for laying out a plot (one version for newly established plots and one for resampled plots)
- 2. File folder containing required datasheets
 - a. Datasheets for plot establishment years
 - i. Set of blank datasheets for each plot (4–12 sets, depending on park)
 - ii. Set of blank plot datasheets on all-weather paper (×2)
 - iii. Extra blank datasheets of pages 1 (×3), 6 (×3), 9 (×5), and 11 (×5)
 - b. Datasheets for plot revisit years
 - i. Set of prepopulated datasheets for each plot, printed directly from database (4–12 sets, depending on park)
 - ii. Set of blank plot datasheets on all-weather paper (×2)
 - iii. Extra blank datasheets of pages 6 (×3), 9 (×3), and 11 (×3)
- 3. Fully charged Tablet
 - a. Files needed for plot establishment years
 - i. most recent protocol SOPs
 - ii. digital field maps for park being sampled
 - iii. most current taxonomic standard being used for the current field season
 - b. Additional files needed for plot revisit years
 - i. scanned datasheets from previous plot visits
 - ii. plot photopoints from previous plot visits

Additionally, each field crew member is responsible for bringing personal items needed for fieldwork such as a day's supply of water and food, a large backpack that can hold both personal items and field gear, sunscreen and hat if needed, rain gear including coat and pants if needed, and any medications for allergic reactions or other health conditions if needed.

See Table 5 for required equipment to be brought to each park by each team for fieldwork. Before leaving for a trip, the checklist will be used and “checked off” when stocking each tub prior to each scheduled trip. The finalized list with checks for each item will remain in the tub as confirmation for field crew that this review was conducted. This list will also be used by the field crew when gathering items in the field for a plot visit (i.e., ☒ in the Goes to Plot column).

Table 5. CUPN required vegetation monitoring equipment list for each park.

In Field Tub ¹ ✓	Required Equipment for Each Field Team for All Sampling Events (Last Updated 7/15/2023)	Goes To Plot ² ✓
–	Field binder (a.k.a. burgundy binder) containing required documents	✓
–	File folder containing required datasheets (including extra blank forms)	✓
–	3-ring binder with current SOPs	✓
–	Fully charged Samsung Galaxy Tablet (preloaded with required files)	✓
–	Charger cords and adapters for Tablet and Camera	–
–	Enclosed clipboards (×2)	✓
–	Weather cover for clipboard and umbrella	If raining
–	Snake gaiters (ensure one pair available for each crew member)	–
–	GPS units with 2 fully charged AA batteries per unit (×2)	✓
–	Extra AA batteries (×8) and battery charger (if applicable)	✓
–	Metal detector and spare 9V battery	✓
–	Battery Tester	–
–	12" long aluminum conduit x 12 (≥ 3 need to go to plot)	✓
–	Pillowcase for transporting conduit	✓
–	Blue anodized numbered tree tags ×20 in tub, should have ≥ 2/plot	✓
–	Nails ×20 in tub, should have ≥ 2/plot	✓
–	Hammer with prongs	✓
–	50-meter tapes (×4)	✓
–	30-meter tapes (×2)	✓
–	Chaining pins (×9) (≥ 7 should go to plot)	✓
–	Pin flags (20+)	✓
–	Fiberglass tent poles (2× 3.16m, 1× 1.37m)	✓
–	Compass (×2)	✓
–	Clinometer	✓
–	Fully charged digital camera with SD card and extra battery	✓
–	Spherical densiometer (concave model)	✓
–	Laser range finder with spare battery and reflector	✓
–	DBH tape (×2)	✓

In Field Tub¹ ✓	Required Equipment for Each Field Team for All Sampling Events (Last Updated 7/15/2023)	Goes To Plot² ✓
–	Compact, waterproof binoculars (8x or higher) for viewing canopy tree leaves	✓
–	Leather gloves (for poison ivy vine removal)	✓
–	10x hand lens and small centimeter (cm) ruler	✓
–	Large and small plastic storage bags for plant samples and other items	✓
–	Meter sticks (×3) and Biltmore stick	✓
–	Roll of colored flagging	✓
–	Roll of duct tape	–
–	Pencils with erasers, black permanent marker and ≥2 all-weather pens	✓
–	Misc. extra items-rubber bands, paperclips, pencil lead	–
–	Plant press with pressing sheets and newspapers	–
–	Field first aid kits (×2)	✓
–	Insect repellent (permethrin ×2, DEET ×2) and sunscreen	–

¹ Prior to leaving office, field crew leader is responsible for ensuring item is present and in adequate quantities in equipment tub

² Prior to leaving vehicle, field crew leader is responsible for ensuring item is among equipment being transferred/hailed from vehicle to plot by field crew

Damaged/lost equipment notes:

Literature Cited

- Cumberland Piedmont Network (CUPN). 2023a. SOP 3 Site selection and plot establishment—Version 1.48. Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—3. Cumberland Piedmont Network, Mammoth Cave, Kentucky. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2299604> (last accessed November 2023).
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Revision Log

Revision History.

Version #	Date	Revised by	Changes
1.1	01/15/12	B. Moore and R. White	Miscellaneous minor editorial changes, clarifications and formatting changes following initial field season. Replaced generalized list of training topics with a detailed training week schedule. Added 2012 monitoring schedule. Updated supply and equipment checklist.
1.2	9/26/12	B. Moore and R. White	Added yellow jacket encounters and estimating cover values to training week schedule. Added need to coordinate with park staff one month in advance where assistance with logistics is needed (Table 1.2). Miscellaneous minor updates to monitoring supplies and equipment checklist.
1.3	3/28/17	C. Bledsoe	Added note that training is scheduled to occur at CHCH each year since is first park. Added note on importance of reviewing SOPs prior to training. Minor miscellaneous updates to training week schedule. Replaced specific annual dates with generalized schedule (e.g., May Week 1, Sept Week 2). Added note that QAQC will occur at parks where enough staff are available to conduct the repeat visits (usually CHCH and MACA). Miscellaneous minor modifications in wording and directions to accommodate transition from establishment to plot revisit. Teams will be provided maps with established points. Need for checking plot coordinates recorded when plot established. Updates to supply and equipment checklist.

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1.35	3/29/20	C. Bledsoe and B. Moore	Changed sentence stating that monitoring would be implemented by two teams to monitoring would be implemented by one or two teams Removed detailed five-day training schedule and replaced with more generalized schedule. Updated NPS RPRS website URL. Correction/change CUGA from Aug week 4 to week 3 in table 1.1. Referenced fact that previous season's operational review will have implications on training topics. Removed recommended personal gear and soil measurement gear from equipment checklist and added to text section. Added note that ArcGIS files will be made available on network server to aid in field map review. Updated equipment checklist-removed un-needed items and added others, moved detailed items from field binder and datasheets folder to text section and added what will be on the Samsung Galaxy Tablet to text section. Added note that a mid-season training will be held to review common errors encountered on datasheets during the field season. Moved Revision History to end of SOP and added more detailed list of changes made to date.
1.36	8/9/2020	B. Moore	Address grammatical changes and clarifying comments made by IMD regional program manager.
1.4	12/16/20	B. Moore	Added statement that modifications of plot attributes (clearing brush, pulling exotics) is not allowed. Added text that field crews should be carrying two independent means of communication when in remote areas and maintain communication with established contacts. Updated summary list of protocol tasks, responsible staff and dates to accomplish (Table 1.2). Cleanup of equipment check list-adjusted item list and quantities; also added a check column of what goes to plot.
1.5	1/14/22	B. Moore	Reviewed and made minor updates to equipment checklist. Added additional details to field work schedule; nothing new just better documentation of what has been occurring and is planned going forward. QA/QC plot selection changed back to original (2011) randomized approach with some caveats. Added two tables (Table 1.1. and 1.3). Added statement indicating field crews will have tablets with Avenza maps to aid in navigation. Removed references to soil sampling (never implemented). Changed request for multi-year permits from 2 to 3-5 years (depending on park schedule). Minor editorial/grammatical changes.
1.53	7/17/23	B. Moore	Minor editorial changes resulting from regional IMD manager review. Reviewed and made minor updates to equipment checklist. Formatted by editor to regional I&M publication standards.