Introduction

The Central Appalachian Spruce Restoration Initiative works to initiate or accelerate the recovery of high elevation red spruce ecosystems by establishing site conditions that, together with natural processes and minimal management intervention, will naturally develop along trajectories that will lead to fully functional, mature red spruce communities. Our long-term management goal is to restore spruce and spruce-mixed hardwood communities to conditions that provide the structural characteristics and ecosystem functions found in late-successional forests similar to those that likely existed in this region prior to the logging era. In order to meet this goal, CASRI engages in both passive and active ecosystem restoration, enhancement and conservation activities.

Active management plans include release of existing spruce in the understory and planting of spruce seedlings and associated species in both open and forested areas to expedite the development of spruce and mixed spruce-hardwood forest structural components, and habitat features. As a science based group initiative, CASRI will work to conduct consistent and accurate monitoring of project sites in order to evaluate success, adjust future actions, and ensure project sites are returning to a natural trajectory. However, because the specific goals, site conditions, and resources associated with a given restoration project may vary widely, a single management prescription and monitoring plan will not fit all projects. Thus, in order to develop an appropriate and consistent monitoring strategy, active management projects will be grouped into several broad categories which will encompass most activities.

Since CASRI’s inception in 2007, our active management projects have been focused largely on planting efforts. As such, this initial monitoring document is intended to focus on the short-term (≤ 10 years) objectives associated with the restoration of red spruce forest communities through artificial regeneration and associated habitat enhancement activities. These restoration objectives include, but are not limited to, the following:

1) Establish or increase the proportion of a viable red spruce component (up to proportions typical of reference conditions) in appropriate sites through planting of seedlings. In forested sites currently dominated by hardwood or non-red spruce conifer species, increase the relative proportion of red spruce in the understory. In open sites, ensure an adequate survival and growth rate for planted seedlings.

2) Increase the diversity of native vegetation in all strata, consistent with that found in reference conditions, while decreasing the proportion of non-native, invasive species in the project area (particularly those considered to represent a threat to ecosystem recovery).

3) Increase coarse woody debris and other structural components (e.g., increased vertical complexity, availability of snags and organic matter) to help improve soil and micro-habitat conditions.

4) Increase use of restored sites by native wildlife characteristic of spruce and spruce-northern hardwood communities in the area.

While a detailed, labor-intensive monitoring plan is not practicable for us to apply at all sites at this time due to limited resources, we have developed a “rapid assessment” monitoring protocol for use in evaluating planting success at our more straightforward sites. The purpose of this protocol is to collect baseline and subsequent monitoring data for use in assessing the success of these reforestation projects. Given restricted budgets and labor, we have designed this protocol to allow annual monitoring to be completed at most sites in a single day. Table 1provides a summary of the rapid assessment monitoring plan, while Appendix A (Monitoring Protocol) gives a more detailed explanation of the plan and specific protocol for each metric.

Additional, more intensive and extensive monitoring protocols are under development for use at a subset of these planting areas, as well as spruce release projects and larger or more complex restoration sites (e.g., reclaimed surface mines) as funding becomes available. In addition, the rapid assessment protocol may need to be modified for site-specific circumstances (e.g., if federally threatened or endangered species are known to occur on-site, wildlife survey protocols would be modified; if in a riparian area with an objective of improved water quality, water quality parameters would be monitored in conjunction with other variables noted herein; etc.)

As data are collected over multiple project areas, the protocol may be modified to reflect the most practicable strategy for meeting our monitoring objectives. This is particularly true of plot numbers, sizes and frequency of monitoring, where results from initial monitoring efforts may indicate that those parameters should be modified to ensure that we obtain statistically sound data through efficient cost and labor outlays.

Methods

Planning

Prior to project implementation on the ground, CASRI members will prepare a base map of the project area, including outer boundaries of planting and other planned enhancement work. This map will be used as the base for placement of monitoring point, transect, and/or plot placement. Using an aerial photo background also will allow future, long-term comparisons of cover type and canopy cover estimates with those of pre-restoration conditions; oblique photos comparisons also may be used, where practicable.

The number of sample plots for assessing spruce seedling survival and growth will be based on project size, and should cover a minimum of 5% of the planting area. However, since this rapid assessment protocol is designed to allow annual monitoring to occur in a single day, it is reasonable to limit the number of plots to 30 as long as that would cover a minimum of 2% of the planting area. The typical plot sizes for monitoring seedling success related to U.S. Forest Service planting is 1/20th acre (roughly 200 m^2; ~14.2 m X 14.2 m square plots or ~ 8 m radius circular plots). Plots should normally be distributed randomly across the project area. However, if an obvious environmental gradient or clear differences in habitat condition are present across the site, random placement should be weighted or stratified accordingly.

Table 1. Central Appalachian Spruce Restoration Initiative "Rapid Assessment" Monitoring Plan for Planting Projects

Objective	Activity	Monitoring Indicator	Schedule[1]
1) Establish or increase proportion of viable red spruce through artificial regeneration.	Planting of tree seedlings	% survival of planted trees	Ys 1 and 3
		Growth of planted trees	Yrs 1, 3, 5, & 10
		Relative proportion of spruce in the understory	Initial (prior to planting) and yrs 3, 5 & 10
2) Increase the diversity of native vegetation	Planting of spruce and other native species characteristic of the area's red spruce ecosystems	Species richness and relative abundance of target species as compared to reference conditions.	Initial and yrs 5 & 10
2) Decrease or elimination of non-native invasive species (NNIS)	Removal of NNIS through appropriate means when found.	Presence/absence and relative abundance of key NNIS	Initial and yrs 5 & 10
3) Increase coarse woody debris	Introduction of coarse woody debris through felling of trees, snag creation or other appropriate means.	Percent cover of CWD	Initial and yrs 5 & 10
3) Increase vertical complexity	Planting, or thinning of woody vegetation where appropriate	Photo points, veg plots, distribution of total cover among vegetative strata	Initial and yrs 5 & 10
3) Increase availability of snags	Girdling of trees	Counts of snags and cavity trees	Initial and yrs 5 & 10
3) Litter & soil organic layer more characteristic of spruce ecosystem	Increase canopy cover (of spruce ecosystem species) and coarse woody debris	Depth of organic layer (O horizon), type of litter/duff material	Initial and yrs 5 & 10
4) Increase wildlife use by species associated with spruce and spruce-NH habitats.	All the above activities in addition to providing specific habitat enhancements as appropriate.	Wildlife surveys	Initial & yrs 5 & 10.

[1] Sampling should occur at the same general time each year; monitoring beyond Year 10 should occur at 5-yr intervals.

GIS can be used to map plot center point locations across the project area; those locations can then be transferred to a GPS for location in the field. Plot locations should avoid obvious discontinuities or habitat breaks (e.g., roads, trails, small ponds) unless they are considered part of the project design/study. CASRI partners and volunteers will mark plot center points and corner locations in the field using rebar or plastic coated metal stakes with flagging where practicable, or another marking method that will allow the points to be located during future monitoring (over at least a 10-year period).

A subset of the plots used for seedling monitoring should also be used for other measurements, including vegetative species richness and relative abundance, canopy cover and dbh, snag and cavity trees, coarse woody debris (CWD), vertical complexity, ground cover, soil OM, and wildlife surveys. NNIS presence and general wildlife use will be assessed both within plots and while traveling between plots. Monitoring protocols contained in the Appendix provide more detailed instructions and forms for all monitoring items noted above. The number of plots included in this portion of the monitoring plan could be determined either by a power analysis using a species accumulation curve based on the reference site (both of which would require pilot data), or by using a general rule of thumb. For the initial sampling (based on a < 30-acre project area such as that proposed for the April planting at CVNWR), we are using a subset of 10 plots. This would give us at least the minimum number of subplots (30 – ten 200m^2 plots, each with three 1m^2 subplots) and transect length (> 100 m – ten plots x 14.2 m = 142 m total length) generally considered to be sufficient to describe variability in a forest stand.

Initial Monitoring and Reference Site Selection

Initial monitoring will be conducted at sites before planting begins to characterize conditions prior to restoration and to provide a basis for subsequent comparisons. It is important that the sites be monitored during the growing season and at approximately the same time each year (within a few weeks if possible), particularly for herbaceous plot comparison over time.

In addition to the project site, reference conditions should be identified as a goal for the restoration site condition trajectory. A reference site could be selected prior to planting; this area would be sampled using the same protocol as that used for the restoration site. The selected reference site should be a relatively mature spruce or spruce-northern hardwood stand that is representative of the conditions that the restoration hopes to achieve. A single reference site could be used for multiple restoration projects, but should be located in the same general physiographic setting as the restoration sites for which it is used, so that the structural and functional values provided are similar to those that could be provided by the restoration site if allowed to follow a natural trajectory. The same parameters should be measured in the reference

site as those monitored in the restoration area; however, they need only be measured once initially and then again far into the future.

An alternative to taking measurements on a reference site is to use conditions determined apriori to be characteristic of a given type of red spruce community (i.e., that which we would envision as the endpoint for a project site’s natural trajectory following restoration). For the purposes of CASRI, the “Key to red spruce NVC [National Vegetation Classification] reference units in West Virginia “ (Byers 2010) provides an excellent guide to the type of (reference) community that a given restoration might strive to set the stage for (given a site’s location, existing conditions, and ecological setting). The key provides a list of vegetative species characteristic of that community, which can be used to assist in planting lists and/or as an endpoint for some of the vegetative species objectives.

Planting

The number of trees planted per acre will vary considerably across the full spectrum of sites due to varying baseline conditions and objectives, and will take into consideration current and desired future stand conditions. However, a minimum of 100 seedlings should be planted per project to allow for growth and survival estimates.

Individual tree spacing will also vary according to existing conditions and site-specific objectives. In order to avoid plantation style results, trees will be planted randomly and in clusters. As a general rule trees should be spaced at least 5-15 feet apart. However, this will vary and should be determined by individual project leaders.

While it is important that monitoring plots not be established on the ground prior to planting in order to reduce potential bias in planting, plots should be established as soon afterward as possible - preferably within one month of planting. Initial seedling counts and marking of seedlings will occur within each plot immediately after establishment to allow for accurate survival estimates in later years. The first survival monitoring should occur the following spring, assuming one full growing season has passed since planting (e.g., if planting occurs in April 2010, the first survival survey should occur in April-May 2011).

Evaluation

Measuring Success

In most cases, short-term success of reforestation projects will be determined based on seedling survival rates. Generally, a $\geq$ 70 percent survival rate is considered indicative of a successful project; however, a higher or lower rate may be considered successful based on the site conditions and specific project goals. The success of other, more long-term monitoring goals

will be determined by analyzing data collected in the monitoring plots established within each project area as part of this plan.

Data Storage

Data collected while monitoring will be stored in a central location for sharing purposes. Data storage location and specifics will be determined by the group as necessary to meet the requirements of group members. As a collaborative group, CASRI should work to make information accessible to all parties interested.

Other Records

Whenever possible CASRI partners should try to keep track of the amount of time and money spent on monitoring. This information will be used to estimate budgets of future projects and be used as a guide when applying for funding.

APPENDIX A: Monitoring Protocols

Mapping Monitoring Plots

1. Develop a map of the project area using GIS, preferably with an aerial photo background.
2. Based on the size of the project area, calculate the number of 200 m^2 plots needed to assess seedling survival.
    a. As noted previously the plots should generally cover at least 5% of the planting area, but it is reasonable to limit the number of plots to 30 as long as that would cover a minimum of 2% of the planting area.
3. Overlay a grid of 200 m^2 blocks onto the project area (or randomly select points at least 30 m apart).
4. Determine whether the site has any obvious physiographic or ecological breaks (e.g., stream or open field in forest; ridge top or steep slope).
    a. If the site is relatively homogeneous, randomly select the required number of plot points (determined in #2) plus 10 additional blocks (for use in case it is determined in the field that one of the primary grid locations is unusable).
        i. Use the aerial photo background to ensure that the plots are located at least 50 m from an obvious habitat edge (e.g., forest vs. field), and that plots do not include roads, trails or other disturbances.
        ii. At times, the project purpose will include restoration of roads, trails or other disturbed areas, such that you want to ensure that these areas are included in the monitoring. In those cases, a subset of plots should be subjectively placed in those locations using aerial photographs or other mapping that shows the disturbed areas.
            1. If the site includes large areas of disturbance to be monitored, plots can be distributed within those areas using a weighted random distribution (as for b. below)

    b. If the site has an obvious ecological break (e.g., one-third of it is field and two-thirds is forest), weight the plot distribution (number of plots) accordingly, then randomly select within each ecological type.
    c. Randomly select ten of the 200 m^2 plots for more detailed (i.e., in addition to seedling survival and growth) monitoring (Figure 1). **[NOTE: Ten is being used as an initial estimate of the number of plots needed. Results of sampling from the first sites (e.g., CVNWR planting in April) will determine whether we need to sample more (up to 20) plots or can get reliable results from fewer plots**]. As noted above, if the site has an obvious ecological gradient or break, weight the plots accordingly
    d. Randomly select one side (N, S, E, or W) of the plot once selected, the same side should be used consistently across all plots in the project area. The only

exception to this is in the case of a sharp gradient in which case the side that crosses the gradient should be selected. The length of the selected side (14.2 m) will be used as a line transect for understory vegetation and woody debris measurements.

e. A 1 m-wide belt transect should be located inside, and 1 m away from, the selected side. The transect should be marked at 1 m intervals for establishment of herbaceous vegetation and ground cover plots (Figure 1).

5. Number/label the plots on the map (including the additional, “just in case” plots) and print out for use in the field.
6. Download the plot center point locations to a GPS unit for location in the field.

Establishing Monitoring Plots in the Field

1. Use GPS to locate plot center points in the field.
2. At each center point, establish a fixed plot marker (rebar or plastic-coated metal stakes are preferred, but if the ground is too rocky for this, tree markers or other long-term marking could be used as well).
    a. Use the center point to establish the four corners and place markers in each of those locations as well (be sure to check that the corners are square and that each side measures 14.2 m)
    b. This center point also will be used as a photo point, with photos taken from that location at a set height looking toward each cardinal direction.
3. The edge of the plot selected for establishing a line transect for vegetation also will be used to assess coarse woody debris (CWD).
4. A 1 m-wide transect will be established along, and at a distance of 1m from, the side of the 200 m^2 transect (see Figure 1). This belt transect will be marked at 1m increments along its length, and three of the 1 m^2 blocks (i.e., plot) will be sampled.

Field Monitoring Protocol

1. **Monitoring tree seedling survival** in the 200 m^2 plot.
    a. It is imperative that all planted seedlings are accounted for within the plots so that survival and growth rates can be accurately assessed during monitoring at years 1 and 3. Thus, immediately following planting and subsequent establishment of monitoring plots, seedlings planted within the plots should be individually tagged or marked (using heavy gage wire and tags to minimize rodent damage).
        i. A baseline Survival Survey form (Table 2) should be filled out, noting any circumstances that the surveyor believes might affect the survival or growth of the seedlings (e.g., deer or burrowing animal activity)
        ii. A sketch map should accompany each plot survey sheet, showing general locations of seedlings in the plot to allow easier location of

dead and/or stunted seedling later (GPS points can be used for this as well, but without sub-meter accuracy, the seedlings may still be difficult to find).

b. During monitoring visits on Years 1 and 3, the Survival Survey form should be used to record the status (e.g., live/height, dead or missing) for each seedling, as well as the potential cause of any observed damage or mortality.

2. **Establishing photo point records.**
   a. The center point of the 200 m^2 plot will be used to record site conditions at each monitoring visit.
      i. The camera should be set up on a tripod (or held) at a consistent height (approximately 2 m) and one photo taken looking toward each of the four cardinal directions using a wide-angle lens. It is important that the photos be taken in as consistent a manner as possible (height, direction, angle, etc.) to ensure that they are comparable across time.
      ii. Photo numbers and conditions should be recorded on the site monitoring data form.
3. **Monitoring canopy coverage, tree dbh, and snag occurrence.** Canopy cover, tree dbh and snag occurrence/condition will be measured within a pre-selected subset of ten of the 200 m^2 plots (see Mapping Monitoring Plots, 4c above).
   a. Canopy cover estimates
      i. A spherical densitometer will be used to take canopy cover estimates at the center points of the plot. Four estimates, one at each of the cardinal directions, are averaged for each sampling point
   b. Point-quarter sampling will be used to record the tree dbh.
      i. From the center point of the plot, the closest tree within each of the four quarters (i.e., NE, NW, SE, or SW) will be identified to species, and the dbh measured and recorded on the field sheet.
   c. All snags located within the plot will be recorded (including GPS location, species ID where identifiable, dbh, height, condition and obvious wildlife use)
4. **Monitoring shrub and sapling vegetation and coarse woody debris (CWD)**
   a. Woody vegetation and CWD will be measured within the same subset of plots as that noted for canopy closure above.
   b. One side of the 200 m^2 plot is randomly selected for use in transect sampling. Once selected, the same side (N, S, E, or W) is used for all plots in the project area (unless a clear gradient occurs within the plot, in which case the transect is place across the gradient).
   c. A measuring tape is stretched along the selected side of the plot and the amount of CWD present along the transect is recorded (i.e., total length of the transect which is crossed by CWD).

i. The attached CWD guidelines should be used to determine how and when to tally wood along the transect and to determine decay class.

d. All woody vegetation ≤ 2 m tall is recorded by species (i.e., total length of the transect which is crossed by each species).
   i. To speed up this metric, the percent cover along the transect will be based on two estimates, made on either end of the transect. The two ocular estimates will be averaged for the plot.
      1. Braun-Blanquet cover classes will be used to record estimates: “R” (rare or solitary, 0.01% cover), “T” trace (<1% cover), 1-5%, 5-25%, 25-50%, 50-75%, 75-100%.
   ii. Where time allows, or when the two ocular estimates are too different to be considered reliable, a normal transect intercept methodology will be used (walking along the transect and recording the total length covered by each species).

5. **Monitoring herbaceous vegetation**
   a. Mark the 1 m-wide belt transect (located ~ 1m inside the plot from the shrub line transect), at 1 m intervals. Stake the center points of three 1 m^2 plots at approximately 2-3 m, 6-7 m, and 10-11 m intervals (Figure 1).
      i. Either string flagging around the 4 corner points of each 1 m^2 plot, or lay down a collapsible 1 m^2 frame that you have carried in with you.
   b. Within each of these plots, estimate the total canopy cover of the foliage of herbaceous species and woody plants less than 1 m in height. While the identification of all herbaceous species may not be known, crews should be able to, at a minimum, identify the following species considered to be characteristic of spruce ecosystems in the area:
      i. *Red spruce (*Picea rubens*),
      ii. *Mountain woodfern (*Dryopteris campyloptera*),
      iii. Intermediate woodfern (*Dryopteris intermedia*),
      iv. Canada mayflower (*Maianthemum canadense*),
      v. Mountain sorrel (*Oxalis montana*),and
      vi. Painted trillium (*Trillium undulatum*).
   c. Make a rapid canopy cover estimate for each species, ignoring overlap among species (i.e., the sum of all species may be > 100% due to overlap).
      i. Use following (Braun-Blanquet) cover classes: “R” (rare or solitary, 0.01% cover), “T” trace (<1% cover), 1-5%, 5-25%, 25-50%, 50-75%, 75-100%.
   d. Record estimates on appropriate field data sheet.
   e. Make every effort to minimize trampling and other potential sampling impacts within these plots.

6. **Monitoring ground cover**. Within each of the 1 m^2 plots, additional ground cover variables will be estimated, including lichen, litter/duff, moss, rock, and woody cover. The same cover class estimates as noted above for herbaceous vegetation will be used. The total ground cover should sum to approximately 100%, i.e. each spot on the ground is described by only one type of cover. Particular care should be taken to avoid trampling within the $1m^2$ plots
    a. Lichen cover
    b. Bryophyte cover – mosses and liverworts
        i. Crews should familiarize themselves with mosses and liverworts in general, with particular focus on three-toothed bazzania (*Bazzania trilobata*), a liverwort that also is a good indicator of red spruce forests, and sphagnum moss (*Sphagnum* spp.)
    c. Litter/duff cover - a continuous layer of accumulated organic matter over forest mineral soil (e.g., scattered leaves over mineral soil is coded mineral soil).
    d. Rock cover - includes any rocks, boulders, or accumulations of gravel > 1/4 inch diameter, or pebbles).
    e. Woody debris - wood pieces included should average greater than 6 cm in diameter and be in contact with the ground; smaller pieces should be included in litter/ duff cover. Stumps, live trunks, and roots are included.
    f. Bare ground.
    g. Other (describe).
7. **Monitoring soil conditions.**
    a. Soil plots also will be located along the 1 m-wide belt transect. These $1m^2$ plots will be located between the ground cover/herbaceous plots, at approximately 4-5 m, 8-9 m, and 12-13 m intervals (Figure 1).
    b. Determine the dominant duff type at the surface of the organic (O) horizon within the 1 m^2 plots (one of three types: hardwood litter, evergreen needles, or other).
    c. Measure and record the depth of the O horizon (i.e., down to mineral soil) in the center of the 1 m^2 plots. Be sure to gently replace the lifted organic matter to the same place after measuring so that the results of the next monitoring visit will not be biased.
    d. Record the appropriate O horizon descriptions(Oa, Oe, or Oi) based on the USDA Keys to Soil Taxonomy (USDA 2010).
8. **Non-native invasive species (NNIS) survey.**
    a. In addition to recording NNIS as part of monitoring shrub/sapling transects and herbaceous plots, field crews will make every effort to identify NNIS encountered within the project area during monitoring (i.e., recorded in 200

m^2 plot subset as well as noted within the overall project area while walking between monitoring plots).

b. The following list of NNIS are considered to pose an ecological risk and, as such, any observations of these species should be GPS'd and reported to the appropriate personnel for removal action:
    i. Garlic mustard (*Alliaria petiolata*)
    ii. Japanese stilt grass (*Microstegium vimineum*)
    iii. Bush honeysuckle (*Diervilla* Mill.)
    iv. Japanese barberry (*Berberis thunbergii*)
    v. Japanese knotweed (*Polygonum cuspidatum*)

    vi. In addition to the five species specified above, an attempt be made to learn and identify the following species: Japanese (vine) honeysuckle, princess tree, tree of heaven, European or Chinese privet, Oriental bittersweet, yellow iris, purple loosestrife, periwinkle, autumn olive (field and shrubby sites only), multiflora rose (field and shrubby sites only), mile-a-minute vine, and any other species that appears to pose an ecological threat.

To the extent that time allows, try to give an estimate of the extent of the infestation (approximate acres or dimensions) and a qualitative estimate of the density (e.g., scattered individuals, patchy, continuous).

9. **Wildlife surveys.**
    a. All wildlife or wildlife sign observations made within the survey plots during monitoring should be recorded on the survey sheet. Any wildlife habitat features installed in the project area (e.g., nest boxes) also should be checked annually. In addition, avian point count surveys and herpetofaunal surveys should be considered for larger sites where long-term monitoring (> 10 yrs) is anticipated. While not practical for all sites, particularly those simple planting sites that will be monitored for < 10 yrs, such specific surveys will allow us to track long-term changes in wildlife use. In addition, special wildlife surveys may be called for at sites within or adjacent to TES habitat.
    b. Avian point count surveys.
        i. The center of the 200 m^2 plots is used as the "point" for point count surveys. Because each point must be at least 250 m from any other point used in the survey, the number of points included in a given project area is limited to the site size and configuration. In a very large site, a maximum of 10 points should be located, and those central to

the project area (i.e., most representative of the effects of the restoration activities).

ii. Point counts should only be conducted by those who are able to identify most WV birds based on their song or call.

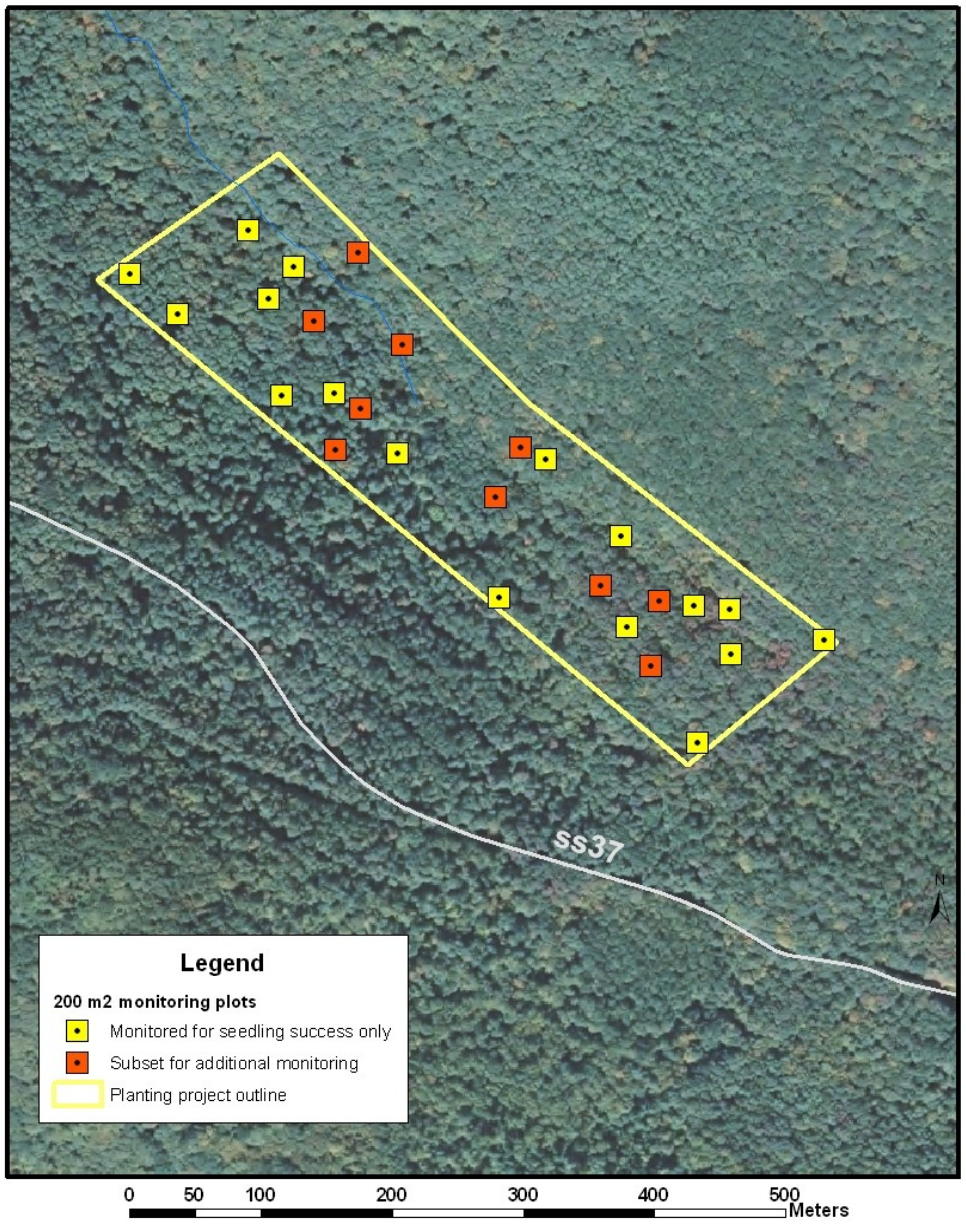
iii. The point count survey does not need to be conducted at the same time as the other monitoring, and must be completed within a defined time frame (generally the end of May through June). Refer to the WV point count protocol for further information and data sheets for point count surveys.

c. Herpetofaunal surveys

i. Several different methods are available for conducting herpetofaunal surveys within the project area, including drift fences, cover boards, time- or area-constrained searches, and other methods. For the purposes of this protocol, we are describing one such method – the use of cover boards – as a relatively quick and consistent method (considering the variety of people that might be conducting the monitoring) for assessing terrestrial amphibian and reptile use over time.

ii. Figure 1 shows one example of a cover board array located within the 200 m^2 plots. This transect is located at least 1 m in from the plot edge and on the opposite side of the plot from the vegetation and ground cover subplots to minimize disturbance associated with those efforts.

iii. Boards in Figure 1 are shown approximately 6 m apart, however the precise number of boards and configuration of the array is less important that the consistency of the methodology across plots.



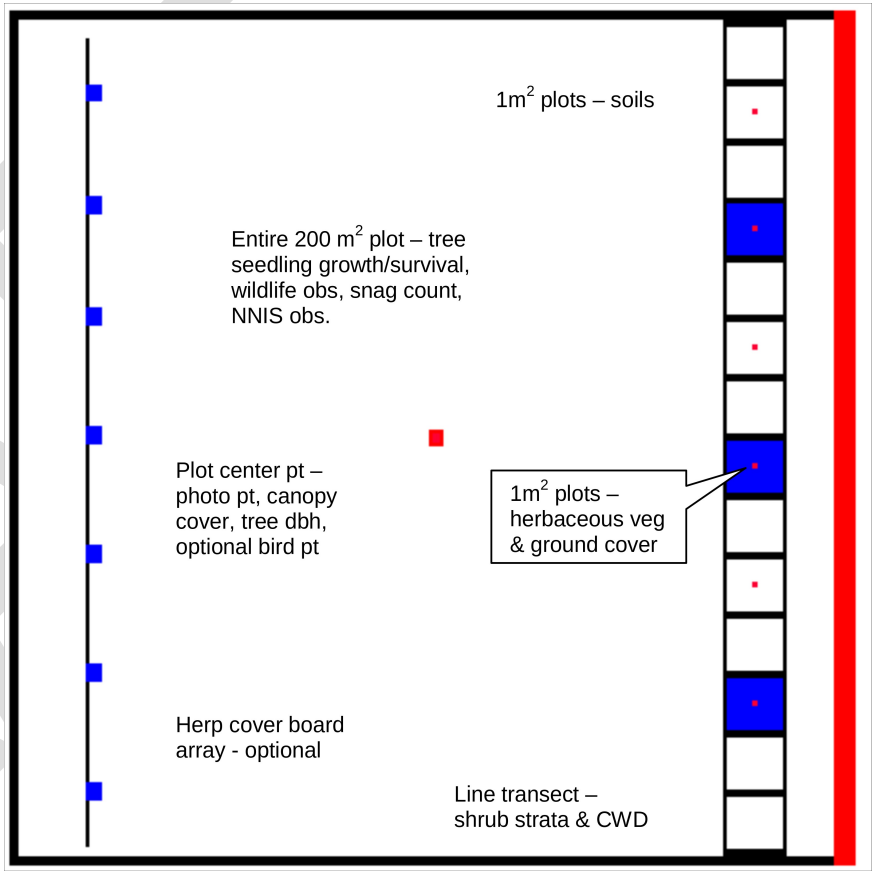


Figure 1. Example of "rapid assessment" monitoring design for a spruce planting project (CVNWR April planting)

Plot Establishment Form (200m^2)

Identifiers/Locators

Site Plot no. _____ Date: _____

Land owner: _____ Quad name: _____

Project leader: _____ Surveyor lead: _____

Additional surveyors: _____

_____

Directions to plot center: _____

_____

_____

Field UTM X: _____m E Field UTM Y: _____m N

Datum:_____ Error +/- _____

Please do not complete the following information in the field:

Corrected UTM X: _____m E Corrected UTM Y: _____m N

Plot photos: Y / N Camera height: _____ Lens type used: regular / wide angle focal length: _____

Photo no(s) used for each cardinal direction N: _____ E: _____ S: _____ W: _____

Photo comments: _____

Environmental Description (general)

Dominant physiognomic class (circle one): Forest Woodland Shrub Herbaceous Non-vascular Sparcely vegetated

Dominant species: _____ _____ _____

Spruce National Vegetation Classification: _____

Topographic position: _____

Soils classification (mapped by soil survey): _____

Environmental comments: _____

_____

Natural & anthropogenic disturbance comments: _____

_____

_____

Evidence of animal use: _____

_____

_____

Other comments: _____

_____

_____

Seedling Survival Survey Form (200m^2 plots)

Site name:_____ **Surveyor:**_____ **Date:**_____

Plot No.	Seedling No.	Species*	1st Year Growth (m)	3rd Year Growth (m)	Mortality/Damage Cause

*Species codes will follow the 4-letter symbols used by the USDA (NRCS plant check list; http://plants.usda.gov/). For example: Red Spruce (PIRU); Yellow Birch (BEAL2); and Sugar Maple (ACSA3).

Non-Native Invasive Species and Snag Locations (200m^2 plot subset)

Site Name:_____ **Surveyor:** _____ **Date:** _____

NNIS species	Estimated cover in overall plot[1]	GPS location (if confined to single location; UTM, NAD83, Zone 17N)
Garlic mustard		X: _____ Y: _____
Japanese stilt grass		X: _____ Y: _____
Bush honeysuckle		X: _____ Y: _____
Japanese barberry		X: _____ Y: _____
Japanese knotweed		X: _____ Y: _____
Japanese (vine) honeysuckle		X: _____ Y: _____
Princess tree		X: _____ Y: _____
Tree of heaven		X: _____ Y: _____
European privet		X: _____ Y: _____
Oriental bittersweet		X: _____ Y: _____
Yellow iris		X: _____ Y: _____
Purple loosestrife		X: _____ Y: _____
Periwinkle		X: _____ Y: _____
Autumn olive		X: _____ Y: _____
Multiflora rose		X: _____ Y: _____
Mile-a-minute vine		X: _____ Y: _____
Other: _____		X: _____ Y: _____

[1] Use Braun-Blanquet cover class codes: “R” (rare or solitary), “T” trace (<1% cover), 1-5%, 5-25%, 25-50%, 50-75%, 75-100%.

Snags

Species	DBH	Height (optional)	Wildlife use [1]	Snag decay class [2]	Comments

[1] **Wildlife Use**: NO=None, SC=Cavities <3”, LC=Cavities >3”, LB=Loose bark, FH=Foraging holes/flaked bark, NE=Nest in tree (species if known)

[2] **Decay class**: 1-5 (see Appendix for description and diagram)

Ground Cover / Herbaceous Plots (1m^2 plots)

Site name: _____ **Surveyor:** _____ **Date:** _____

1 m^2 plot ID: _____		**1 m^2 plot ID:** _____		**1 m^2 plot ID:** _____	
Surface layer	**% Cover[1]**	**Surface layer**	**% Cover[1]**	**Surface layer**	**% Cover[1]**
Lichens		Lichens		Lichens	
Bryophytes (moss, liverworts)		Bryophytes (moss, liverworts)		Bryophytes (moss, liverworts)	
Three-toothed Bazzania		Three-toothed Bazzania		Three-toothed Bazzania	
Shagnum moss		Shagnum moss		Shagnum moss	
Litter/duff		Litter/duff		Litter/duff	
Rock cover		Rock cover		Rock cover	
Woody debris		Woody debris		Woody debris	
Bare ground		Bare ground		Bare ground	
Other _____		Other _____		Other _____	
Herbaceous layer	**% Cover**	**Herbaceous layer**	**% Cover**	**Herbaceous layer**	**% Cover**
Red spruce		Red spruce		Red spruce	
Mountain woodfern		Mountain woodfern		Mountain woodfern	
Intermediate woodfern		Intermediate woodfern		Intermediate woodfern	
Canada mayflower		Canada mayflower		Canada mayflower	
Mountain sorrel		Mountain sorrel		Mountain sorrel	
Painted trillium		Painted trillium		Painted trillium	
Garlic mustard		Garlic mustard		Garlic mustard	
Japanese stilt grass		Japanese stilt grass		Japanese stilt grass	
Bush honeysuckle		Bush honeysuckle		Bush honeysuckle	
Japanese barberry		Japanese barberry		Japanese barberry	
Japanese knotweed		Japanese knotweed		Japanese knotweed	
Other ferns		Other ferns		Other ferns	
Other forbs		Other forbs		Other forbs	
Other grasses		Grasses		Grasses	
Other _____		Other _____		Other _____	
Other _____		Other _____		Other _____	

[1] Use Braun-Blanquet cover class codes: “R” (rare or solitary), “T” trace (<1% cover), 1-5%, 5-25%, 25-50%, 50-75%, 75-100%