SAMPLING PROTOCOL (last revised 27 May 1998)
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The forest vegetation plots are each 500 m^2. This equates to a 12.62-m radius circle. The intention is that each plot will contain 50 to 60 canopy-sized trees. Some forest stands are considerably more dense than this (usually they are spruce/fir stands), and under these circumstances the plot radius can be reduced to 10 m (314 m^2). (The hard part is estimating how many trees there are in the plot.) If the plot radius is reduced to 10-m radius, please note this clearly on the data sheet. Also remember that the sapling/seedling transect should still be 1 by 24 m (see below) even if the plot radius is reduced. Each plot is identified with a gray PVC pipe placed in the center of the plot with a round aluminum ID tag and UTM coordinates. The plots are arranged along N-S transects originating at the Forest Service road along Hubbard Brook. The plots are separated by either 100 m or 200 m (horizontal distance not distance along the slope). The plots are arranged in a regular pattern along each transect. The transects are separated by 500 m (horizontal distance) and the odometer mileage for each transect is noted on the project map.

The data collected inside each individual plot are divided into four categories: plot level information, canopy tree measurements, sapling and seedling measurements, and soil measurements.

Plot information and description

For each plot, the transect number e.g., 780, and plot number are recorded on the data sheet. The data recorder separated by a '/' from the other crew members should be noted, and the person who cored the trees should be identified by a "(corer)" next to their name. The elevation, aspect, and the slope measured to the edge of the plot in the four cardinal directions should be recorded. The compass declination is approximately 16º E i.e., true north is approximately 16º E of magnetic north. These measurements will be compared to those calculated from the GIS database for Hubbard Brook. NOTE: the altimeter should be calibrated each morning at one of the USGS benchmarks along the Forest Service road. It is also a good idea to let the altimeter equilibrate a while after reaching a plot. The UTM information should be copied from the plot marker onto the data sheet. The aspect of the plot should be measured relative to an imaginary plane intersecting the plot center and facing the direction of water flow—the so-called “fall line”. Each data sheet should include a plot description e.g., presence (and location) of a canopy gap, ephemeral streams, large boulders, blow downs, etc. This information is supposed to help me in analyzing the data and to help the next person find the plot 10 years from now. Especially helpful are any observations that may relate to the logging history of the valley e.g., presence of a logging road. The dominant herbs (wildflowers) for each plot are also to be noted. Operationally, the most abundant species are listed first followed by 'some' for less abundant species. For example, "Dryopteris, Oxalis, Clintonia, some Trientalis, Coptis"

Canopy tree measurements

Within each plot, all trees (both alive and dead) greater than or equal to 10 cm at breast height (BH, 1.37 m) are to be measured and tagged with a rectangular, numbered aluminum tag secured with a 3 inch aluminum nail. The tag should be placed either above

or below BH (preferably above) and the nail should be roughly perpendicular to the bole of the tree. A few blows of the hammer are all that are needed to secure the tag. DBH should be measured to the nearest 0.1 cm, and measurements are to be made from the uphill side of a tree. Trees should be tagged sequentially from the inside to the outside edge of the plot and in a clockwise direction around the plot. The first tree tagged in each plot should be a tree uphill from the plot center growing along (or near) the painted N-S transect line. The tags should all face the plot's center.

After a tree is measured and tagged, it is identified to species (use the appropriate species code). If the identification is not certain, then a leaf and twig sample should be bagged, marked and brought back to Pleasant View for identification. A tree's crown status is assigned to one of four categories: dominant (D), codominant (C), intermediate (I), or suppressed (S). A dominant rating implies that the top of the tree's canopy is above its neighbors and is in no way competing for light. A codominant rating implies that the tree is sharing the top of the forest canopy with one adjacent neighboring tree and is competing with that neighbor for light. An intermediate rating implies that the tree's canopy is at the level of the forest canopy but is sharing the canopy with two or more adjacent neighboring trees. A suppressed rating implies that the tree's canopy is below the forest canopy and is light limited. Its crown condition is rated as either I, if 80–100% of the tree's potential foliage is intact; II, if 50–80%; III, if 10–50%; or IV, if less than 10% of the potential foliage is intact. It is also useful to note any unusual characteristics of the tree e.g., tree is leaning, roots grow around a boulder, etc. Assessing a tree's crown status and condition tends to be the most difficult measurement because it is so subjective. Occasionally there are legitimate differences of opinion. However, the purpose of assessing a tree's crown status and condition is to relate its canopy position to its potential growth rate. This purpose should be kept in mind when assessing trees.

<u>special cases</u>

Wounded trees: if a tree has a wound at breast height, then it should be measure either above or below BH and noted as such. The DBH measurements are used to calculate forest basal area and biomass, so the most representative measurement of the tree should be used.

Clumped trees: if there is more than one stem originating from the same root system, then each stem that is 10 cm DBH or larger should be measured as a separate tree and given a unique tag. These clumps should be noted on the data sheet.

Split trees: if a single tree splits into two stems below BH, then each stem should be counted separately and noted as such on the data sheet.

Dead trees: if a tree is dead, then it is not necessary to record the tree's crown status. However, the tree's crown condition should be recorded as a IV and it should be noted whether the tree is either standing dead, a snap-off, a tip-up, or a stub. A standing dead tree is largely intact, but its top may have fallen off. A snap-off is a tree whose bole has been broken by the wind, another tree, etc. Usually several lower branches are still intact, and the broken part is laying (lying?) near by. A tip-up is a tree whose root system whose root system has been pulled out from the ground. Usually the entire tree is intact,

and sometimes the tree continues to live. A stub is a short section of the bole without any branches. While most dead trees are to be tagged, if a dead tree would fall over during the process of tagging or is likely to fall over within the next year or so, it should not be tagged. Instead it should still be measured and noted as a “no tag” on the data sheet, and if its species cannot be determined the species code “UK” (unknown) should be recorded on the data sheet.

Line calls: if it unclear whether a given tree is inside the plot, the yellow rope should be extended in the direction of the tree to make the determination. If 50% of the tree’s bole (measured at the base of the tree) is inside the plot, then the tree is ‘in.’ If it’s less than 50%, then the tree is ‘out.’ If there is a slope to the plot, the yellow rope should be leveled first—either end of the rope can be raised or lowered as needed. Remember, plots are to be 500 m^2 projected area not relative to the slope of the plot. Be careful not to pull over the plot marker. Line calls should be made as objectively as possible in order to minimize any bias in the selection of trees.

Coring

Each tree that is tagged is also to be cored using the increment hammer (Swedish hammer). Select a side of the tree that is round, and if there is a significant slope to the plot, select a side that is parallel to the contour. Whack the tree with the hammer at approximately BH and as perpendicular to the bole as possible. Use the hammer’s plunger to extract the core. Put the whole hammer inside a plastic bag, and smack the plunger against a tree or gently tap the plunger against a tree until the core pops out. Place the core in the plastic tray with the most recent growth (the glossy side) towards the right. Write the tag number of the tree on the tray above the core. It is not necessary to core dead trees, but it is helpful to leave a place-holder for the core in the tray. Put a slash "/" through the tag number on the tray to indicate that the tree is dead. At the end of a day of sampling, the plastic trays containing the cores should be put into the freezer in order to preserve the cores.

Sapling and seedling measurements

The understory regeneration in each plot is measured in a 1 by 24 m strip transect arranged along the E-W diameter of the plot. The direction of the yellow rope should be positioned using a Silva compass. The rope should be extended as straight as possible, and the end of the rope should be pinned to the ground using a stick in order to keep the rope in place. Typically, the rope is extended first to the east and the saplings, seedlings, and soil depth are measured and then the rope is extended to the west and the measurements are repeated. All live saplings (less than 10 cm DBH) are to be identified to species, counted and tallied according the size classes (0–2, 2–4, 4–6, 6–8, and 8–10 cm) on the data sheet. All live established seedlings (greater than 50 cm tall but less than BH) are to be identified to species and counted and tallied. The height determination is made by examining the length of the plant’s woody growth not its leaves.

Soil measurements

The soil depth for each plot is characterized by inserting the soil depth probe into the soil profile at meter intervals along the 1 by 24 meter strip transect. Twenty five measurements including the plot center should be made. Because soil depths are highly variable and both accuracy and precision are problems, measurements should be recorded to the nearest 2 centimeters for measurements less than 20 cm and to the nearest 5 centimeters for deeper measurements. The measurements are not intended to include the depth of the litter layer. Operationally, this means stick your finger down the shaft of the soil probe into the soil and locate the nearest scale marking. The motivation for the measurements is to measure the depth to obstruction or potential rooting volume so the probe should be inserted until either a rock is hit or the handle of the soil probe is reached. Often a gravel layer is reached which can be penetrated by repeatedly ramming the soil probe up and down. If a root is struck, the probe should be moved slightly and inserted again. If the transect runs through a stream, a large boulder, etc. this should be noted on the data sheet. In addition, if the strip transect crosses a surface rock or log, the soil probe should be moved to the point nearest the meter mark that is not on the rock or log. The motivation for making these soil depth measurements is to characterize the depth to obstruction of the soil layer so the measurements need not be made exactly at the meter marks.