

Woody Plant Inventories, CVS-EEP Protocol

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Woody plants are typically inventoried in all five levels of the CVS-EEP protocol, although such inventory is optional in Levels 3 and 4. Woody plants fall into two broad categories **planted** and **natural**.

Planted woody plants (described in blue in the left column in this document) are those intentionally planted as part of a restoration effort, and may have originated as transplants, live-stakes, balled and burlapped plants, potted plants, tublings, or bare-root seedlings.

Natural woody plants (described in green in the right column in this document) are those not planted and are sometimes referred to as “volunteers.”

The CVS-EEP protocol requires positive confirmation (from a planting plan, or previous monitoring records) or strong evidence (e.g., remnants of burlap or potting media) for a woody plant to be considered of planted origin.

Without positive confirmation or strong evidence of a woody stem being planted, it is considered to be of natural origin.

Three different measurements are taken on plants. Height always refers to the length of the stem, which for vertical stems is the true height. For leaning stems, the height is measured along the length of the stem. Diameter at decimeter height (ddh, always written lowercase) is the diameter of the stem measured at 10 cm in height (which is 10 cm measured along the stem for leaning stems). Diameter at breast height (DBH, always written uppercase) is measured at 1.37 m along the stem, which in the case of a vertical stem is 1.37 m above the ground. Fundamental concepts and inventory procedures differ between planted and natural woody plants.

Each planted woody plant is considered and inventoried as a single individual, regardless of the number and size of stems emerging from a common root system.

Natural woody plants, in contrast, are inventoried in two broad size categories, seedlings (those plants with no stem achieving breast height) and saplings / trees (those plants with at least one stem achieving a length of at least 1.37 m [breast height for vertical stems]).

One or more of height, ddh, and DBH are measured, depending on the size and origin of a plant. No tallies are made for planted stems.

A natural woody seedling, like a planted woody plant, is considered and inventoried as a single individual, regardless of the number and size of stems emerging from a common root system. A natural woody sapling/tree with a single stem is also considered and inventoried as a single individual. However, a natural woody sapling/tree with multiple stems may be considered and inventoried as multiple individuals if the stems split below 50cm in height (along the stem). Seedlings are tallied based on three classes of length [height] achieved by the longest [tallest] stem: 10-50cm, 50-100cm, and 100-137cm. Saplings (stems 0-2.5 cm DBH) are tallied based on two DBH classes: 0-1.0 and 1.0-2.5 cm DBH, whereas trees (stems > 2.5 cm DBH) are tallied based on multiple DBH classes starting at 2.5 cm DBH (2.5-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40cm, and to the closest cm exceeded for stems >40cm). Stems exceeding 40cm are the only explicit measurements recorded for natural woody stems, as all smaller stems are counted in their various size classes.

The different CVS-EEP inventory levels include or exclude various classes of woody stems, and different measurements are made on the various classes of stems, as shown in the following scheme:

Woody Plant Inventories, CVS-EEP Protocol				
Level or measurement	Planted Plants	Natural Plants		
		seedlings	saplings	trees
Level 1	yes	no	no	no
Level 2	yes	yes	yes	yes
Level 3	optional	optional	optional	optional
Level 4	include in natural	no	optional	optional
Level 5	include in natural	no	yes	yes
ddh	yes, with exceptions	no	no	no
Height	yes	tallied in classes	no	no
DBH	yes, if tall enough	no	tallied in classes	tallied in classes
Multiple stems	measure largest	measure largest	measure all if split below 50cm	measure all if split below 50cm

Planted Woody Plants Details

The inventory of planted woody plants involves monitoring of various dimensions and conditions (vigor and damage) of specific plants through time. Because a given plant is always treated as a single individual, only a single kind of dimension or condition can be assigned to a plant at any particular time. When a plant has multiple stems emerging from a common root system, it is possible that different dimensions might be determined on different stems belonging to the same plant. For example, ddh (diameter at decimeter height) is determined on the stem with the largest diameter at 10 cm along the stem, typically 10 cm above the soil surface. DBH is determined on the stem with the largest diameter at breast height, and overall height is determined by stem length from rooting location to that living perennating bud farthest from the base of the stem. It is entirely possible that these attributes might be determined, when appropriate, from different stems belonging to the same plant. The specific dimensions determined for planted woody plants (including the units and precision used) are summarized in the following table:

Required Measurements, Planted Woody Plants			
Height or Type	ddh mm units	Height cm units	DBH cm units
< 1.37 m tall	yes, mm precision	yes, cm precision	no
≥ 1.37 m and < 2.5 m tall	yes, mm precision	yes, cm precision	yes, cm precision
≥ 2.5 m and < 4.0 m tall	no	yes, dm precision	yes, cm precision
≥ 4.0 m tall	no	yes, 0.5 m precision	yes, cm precision
Live stake	no	yes, cm precision	yes if ≥ 1.37 m tall, cm precision

Natural Woody Plants Details

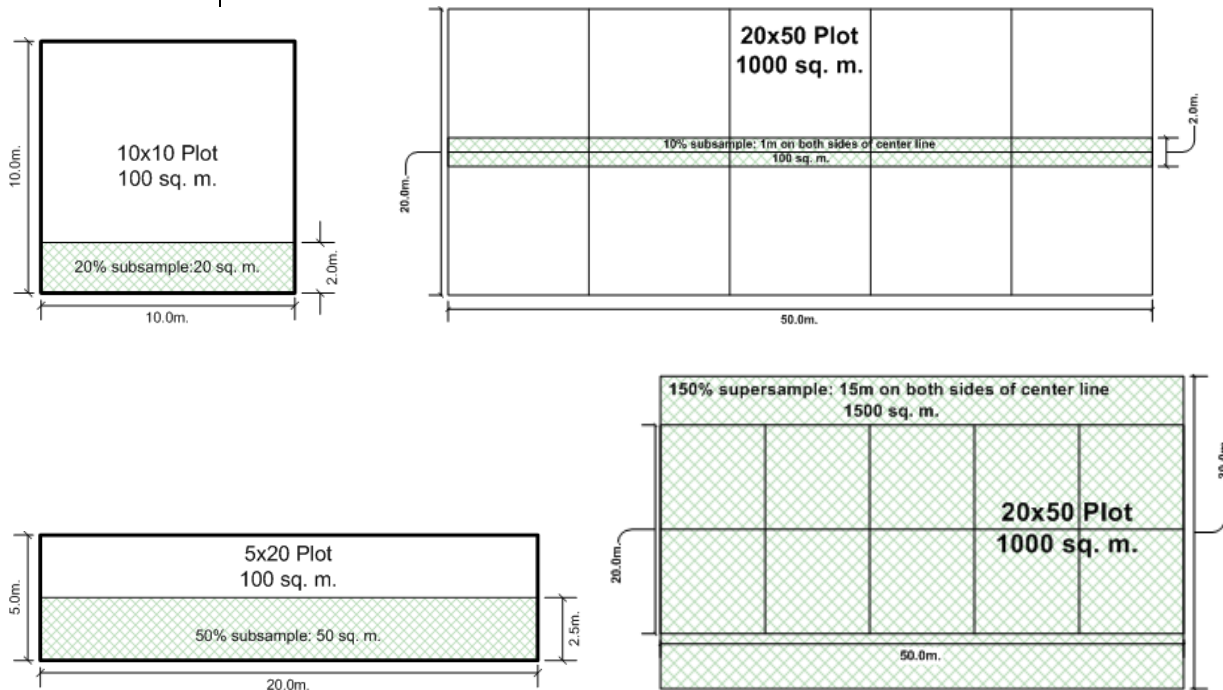
Natural woody plants are tallied in size classes, based on critical dimensions. Seedling plants are placed in one of three size classes, based on length (or height, for vertical stems) of the longest stem: 10-50 cm, 50-100 cm, and 100-137 cm. Because a given seedling plant is tallied as a single individual, regardless of the number of stems, that plant is tallied only once, with its class based on the length (height) of its longest living stem. Seedling plants that do not achieve a length of 10 cm are not tallied under any circumstance. A height cut-off (in reality a length

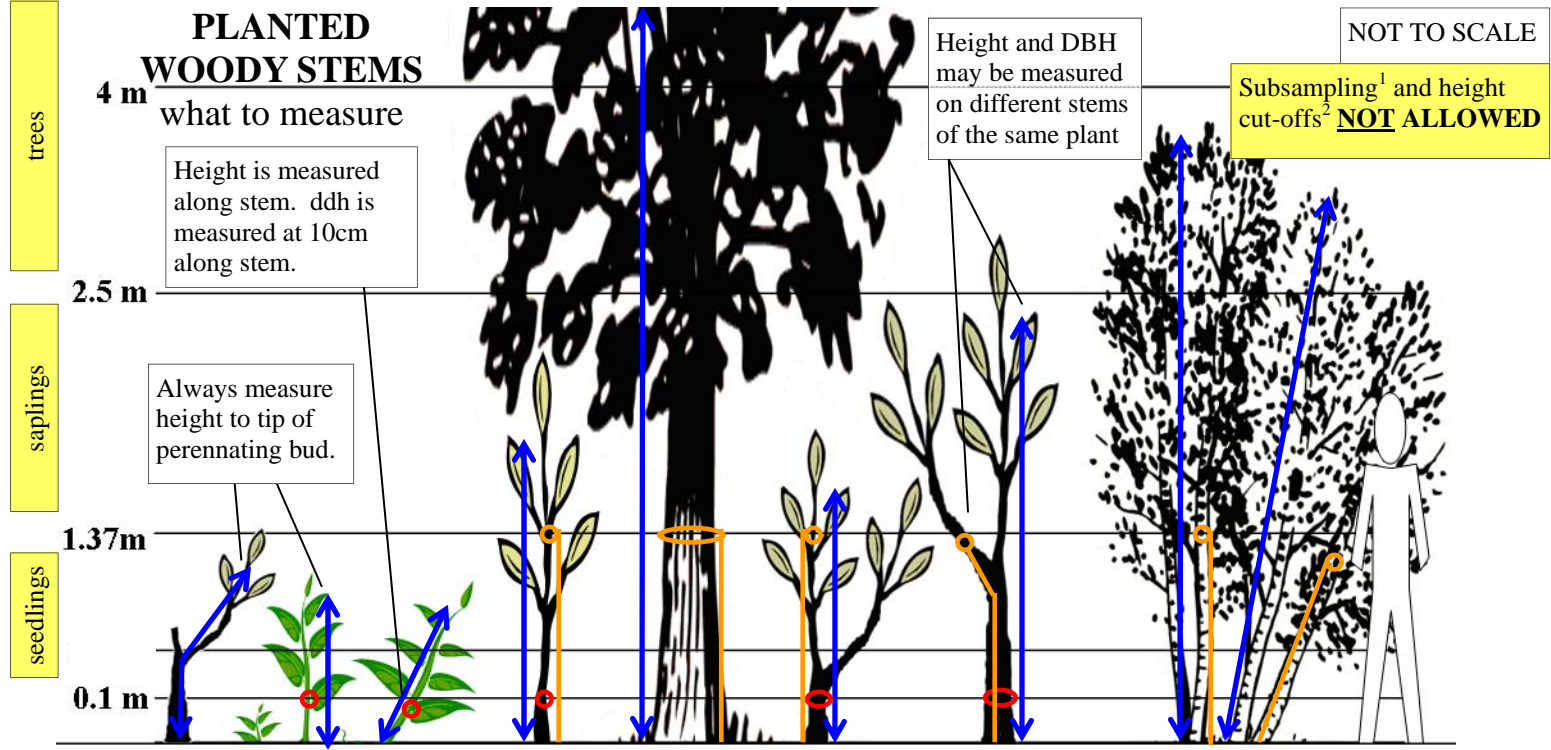
cut-off) may be selected during a particular inventory of a given plot that will eliminate one or more seedling classes from the inventory. For example, a height cut-off of 10 cm would include plants in all three length (height) classes, whereas a height cut-off of 100 cm would exclude from the inventory all plants except those with at least one stem achieving a length (height) of 100-137 cm. The permissible height cut-offs are 10, 50, 100, and 137 cm. If a height cut-off other than 10 cm is selected, an explanation must be provided. A height cut-off of 1.37 m implies that seedlings will not be tallied.

Natural woody plants that have at least one stem reaching breast height are tallied in sapling/tree DBH classes, but are excluded from the seedling tally, even if they have additional stems that fail to reach breast height. Natural woody plants with multiple stems reaching breast height may have those stems tallied separately in the appropriate DBH classes of saplings or trees under certain circumstances. The criterion for separate tally of a natural woody stem as a sapling or tree is that it emerges as an independent stem below 50 cm above the soil surface (or along the stem in the case of a leaning individual).

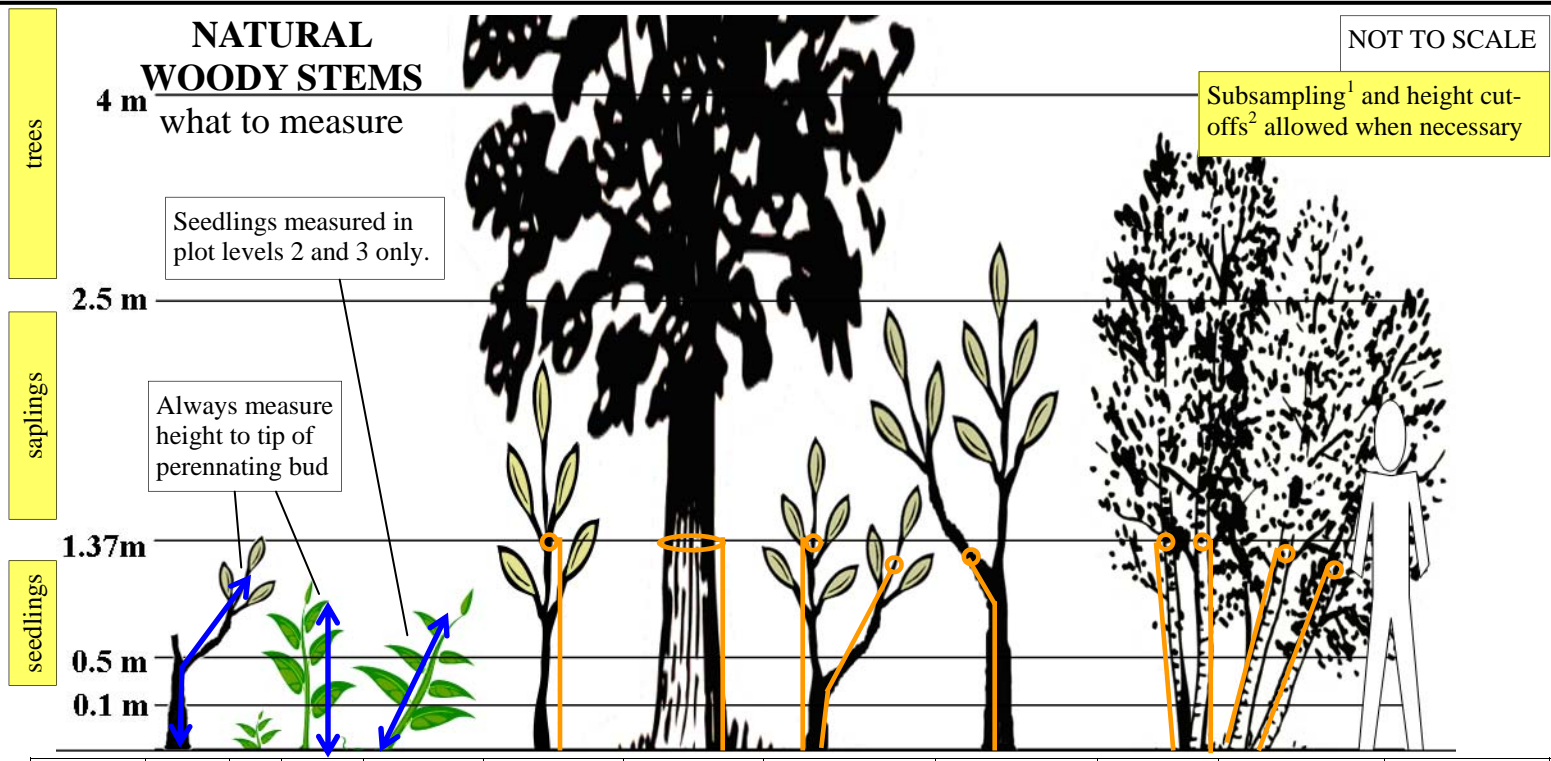
Subsampling of planted woody plants is never permitted.

Subsampling / supersampling of natural woody plants are possible under certain circumstances. Subsampling is permitted when a subsample would provide a representative estimate of stem density while realizing a significant saving of time / labor. Seedlings and saplings of natural woody plants (but not trees) may be subsampled in Levels 2 and 3, and both saplings and trees may be subsampled in Levels 4 and 5. Subsampling / supersampling are generally based on changing the distance from the baseline edge of the plot for inclusion of stems. For example, a 10% subsample would include stems in a 1m wide band along the baseline. Common subsamples are 10, 20, and 50% of a plot. Trees may be supersampled (that is, tallied in an area extending beyond the boundaries of the plot) in Levels 2-5 when this would yield a better “snapshot” of stand structure, typically for cases of sparse stems and at levels ranging from 150-500%. A supersample is indicated using a percentage greater than 100 in the subsample column for trees. Some common subsampling and supersampling strategies are illustrated below.





Planted Woody Stems	Live stake	< 10 cm tall	Seedling < 1.37m	Leaning seedling	Sapling/tree 1.37m-2.5m tall	Large tree > 4m tall	Multi-stemmed plant	Multi-stemmed plant	Sapling/tree > 2.5m tall	Leaning multi-stemmed sapling/tree, > 2.5m tall	Notes on measurement
ddh (mm), 10 cm along stem	no	no	yes	yes, 10 cm along stem	yes	no	Measure larger stem	Measure larger stem	no	no	In red, ddh measured 10cm along stem, mm units.
Height (cm) to tip of bud	yes	no	yes	yes, along stem	yes, 1 cm precision	yes, 0.5m precision	Measure longer stem	Measure longer stem	Yes, 0.1m precision	Yes, 0.1m precision	In blue, measured along stem
DBH (cm), 1.37m along stem	yes, if tall enough	no	yes	no, not tall enough	yes	yes	Measure larger stem	Measure larger stem	Yes, larger stem	Yes, larger stem, along lean	DBH orange circles; lines 1.37m along stem



Natural Woody Stems	Multi-stemmed seedling < 1.37m tall	< 10 cm tall	Seedling < 1.37m	Leaning seedling	"standard" sapling/tree	Large tree	Multi-stemmed sapling, split below 0.5m	Multi-stemmed plant, split above 0.5m	Multi-stemmed plant, split below 0.5m	Leaning multi-stemmed plant, split below 0.5m	Notes on measurement
Height classes	only longest stem	no	yes, level 2-3	yes, along stem, level 2-3	no	no	no	no	no	no	blue, 10-50, 50-100, 100-137cm classes
DBH classes	no	no	no	no	yes	yes	Measure all stems, 1.37m along stem	Measure larger stem	All stems splitting below 0.5m	All stems splitting below 0.5m	DBH orange circles; lines 1.37m along stem

¹Subsampling: including natural stems in only a part of the plot (e.g., 20%). ²Height cut-offs: excluding natural seedlings less than a height (50cm, 1m, or 1.37m).