

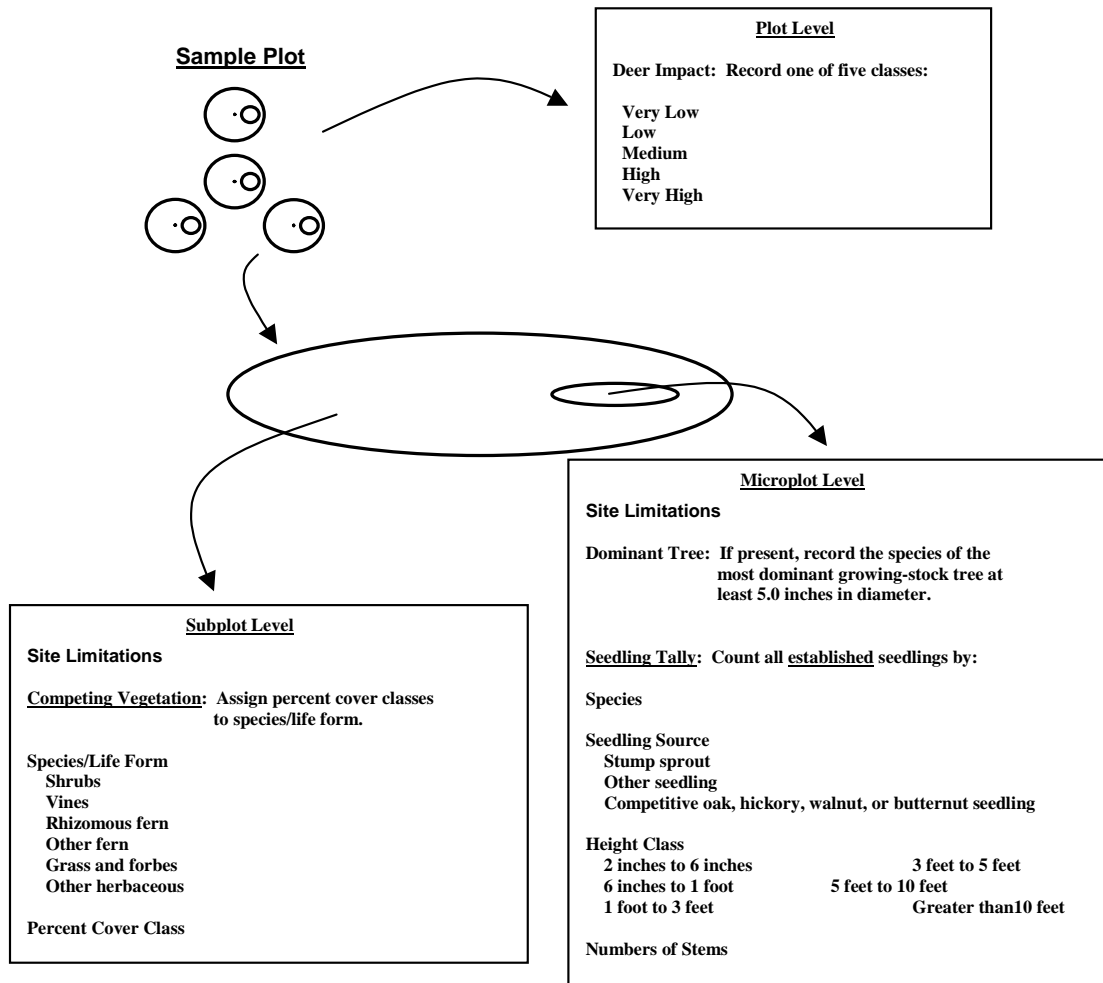
## Appendix I – Special Studies

### FIELD INSTRUCTIONS FOR PENNSYLVANIA’S REGENERATION STUDY (PRS)

#### Overview

The regeneration assessment is being conducted in Pennsylvania at the request of the State’s forestry community. There is concern that regeneration is lacking in many stands and with over half of the State’s forests in a financially mature condition, this is a critically important issue. The regeneration data will provide answers to questions about advance regeneration, post-disturbance regeneration, and future forest composition. The data will be used to quantify regeneration adequacy statewide, provide estimates of numbers of seedlings per acre, and for research into regeneration dynamics. Regeneration plots are selected prior to the field season and are visited during the leaf-on season from June through September.

The figure below summarizes measurements needed for the regeneration assessment. Data are collected at three levels: the entire sample plot, the subplot, and the microplot. **The associated vegetation and regeneration tallies should be completed for all accessible forest land conditions that are encountered.**



## PLOT DATA

### State, Unit, County, and Plot Number

Refer to Section 1 of this field guide.

### Month/Day/Year

Refer to Section 1 of this field guide.

### Deer Impact

Estimate the amount of browsing pressure that deer are exerting on regeneration. Deer impact is a function of deer population and the amount of available food sources within one-square mile surrounding the plot.

Code	Definition
1	<b>Very Low</b> - Plot is inside a well-maintained deer enclosure.
2	<b>Low</b> - No browsing observed, vigorous seedlings present (no deer enclosure present).
3	<b>Medium</b> - Browsing evidence observed but not common, seedlings present.
4	<b>High</b> - Browsing evidence common <u>OR</u> seedlings are rare.
5	<b>Very High</b> - Browsing evidence omnipresent <u>OR</u> forest floor bare, severe browse line.

Degree of deer browsing can be a difficult variable to quantify due to preferences that deer have for various food sources and the elusive nature of deer populations. Although not a complete list of species in Pennsylvania, the following deer preference list may be useful for assigning deer impact:

Species	Browse Preference	Tolerance of Browsing
Black Cherry	L	L
Fern	L	H
Grass & Sedge	L-M	H
Striped Maple	L-M	H
American Beech	M	H
Birches	H	M
Oak	H	M-H
Hickory	H	M-H
Ash	H	M
Rubus spp.	H	M-H
Pin Cherry	H	L
Red Maple	H	L
Sugar Maple	H	L
Yellow-poplar	H	L
Cucumber tree	H	L
Eastern Hemlock	H	L

In addition, a handout showing the Pennsylvania Game Commission's estimates of deer density by county will be provided. Deer densities in excess of 20 deer per square mile of forest are generally considered to inhibit the development of tree seedlings.

**SUBPLOT DATA**

Complete the subplot data for all forested conditions.

**Subplot Number**

Record the code corresponding to the subplot number.

**Condition Class Number**

Record the corresponding condition class number.

**Site Limitations**

Record site limitation codes 2 and 3 if they occur on at least 30 percent of the subplot or condition area, else record as code 1.

Code	Definitions
1	No site limitations
2	Rocky surface with little or no soil
3	Water-saturated soil (during the growing season)

**Competing Vegetation**

Assign percent cover classes to species/life forms within the subplot. The sum of the percent cover classes may exceed 100 percent. For subplots with more than one condition, only record percent cover for the portion of the subplot in the condition. For example, if 50 percent of the subplot is in a condition and is entirely covered with *Rubus* spp., record 99 for percent cover class (100 percent cover).

**Species/Life Form**

Code	Definition
	Deciduous Shrubs, all valid NEFIA species codes (see Appendix F)
	Evergreen Shrubs, all valid NEFIA species codes (see Appendix F)
	Vines, all valid NEFIA species codes (see Appendix F)
	Invasive Vines, Shrubs and Forbs (see footnote for selected invasives <sup>1</sup> )
0001	Rhizomous Fern, including Bracken, Hay-scented, and New York
0002	Other Fern
0003	Grass
0004	Other Herbaceous

**Percent Cover Class**

Assign a cover class to each species or life form.

Code	Definition	Code	Definition
01	1 to 9 percent	50	50 to 59 percent
10	10 to 19 percent	60	60 to 69 percent
20	20 to 29 percent	70	70 to 79 percent
30	30 to 39 percent	80	80 to 89 percent
40	40 to 49 percent	90	90 to 100 percent

As an aid in determining percent cover, consider that one-percent cover of the 24-foot radius subplot is equivalent to a square 4.2 feet on each side or a circle with a radius of 2.4 feet. Ten percent cover is equivalent to a square 13.4 feet on each side or a circle with a radius of 7.6 feet.

<sup>1</sup> Invasives to include are describes in the INVASIVE PLANTS FIELD GUIDE. The codes to include in the Species/Life Form tally include the vines, shrubs, and two forbes listed below.

Vines		Shrubs		Forbes	
9882	Fiveleaf akebia	9888	Winged Euonymous	9899	Japanese knotweed
9883	Porcelain-berry	9889	Border privet		Giant knotweed
9456	Oriental bittersweet		Common privet		
9884	English ivy				
9885	Mile-a-minute vine				
9886	Kudzu				
9887	Common periwinkle				

**MICROPLOT DATA**

Complete the microplot data for microplots within accessible forest land.

**Microplot Number**

Record the code corresponding to the microplot number (same as subplot number).

**Microplot Center Condition Class**

Record the corresponding condition class number.

**Site Limitations**

Record the following site limitation if it dominates the area of the microplot or condition:

Code	Definition
1	No site limitation
2	Rocky surface with little or no soil
3	Water-saturated soil (during the growing season)
4	Thick duff layer (in excess of two-inches thick)

**Dominant Tree**

Record the presence/absence of at least one growing-stock tree 5.0-inches or larger in diameter at breast height on the microplot or condition by recording species code. If there are no such trees, record as "000." If more than one such tree is present, record the species code of the tree with the largest diameter.

**Tree and Seedling Data**

Tally all established seedlings (<1.0-inch DBH) for stems rooted within the microplot by species, seedling source, and height class.

Count all seedlings at least 2-inches tall with at least two normal-sized leaves that do not still bear cotyledons.

For most species encountered, the tug test should be used to determine if seedlings are established. Seedlings that slip out of the ground with a slight tug do generally not have sufficient root systems to survive through the growing season and are not established.

- Small oak, hickory, walnut, and butternut seedlings (less than 1-foot tall) should be at least 6-inches tall or have a root-collar diameter (RCD) of at least 0.20 inches.
- Pine seedlings should have at least two whorls or be at least 6-inches tall.

### Species

Record valid NE-FIA tree species code (see Appendix 3).

### Seedling Source

Discriminate between stump sprouts and other seedlings. Tally clumps of stump sprouts as one seedling and tally only the tallest, most dominant sprout for each stump. Tally sprouts on stumps that originate from cutting or mortality only. Stumps must be at least 2 inches in diameter to qualify as having sprouts.

A special code (3) is used for oak, hickory, walnut, and butternut that are classified as “competitive.” Research indicates that competitive seedlings are highly likely to become dominant or codominant stems in the next stand. To be classified as competitive, stems must have an RCD > 0.75 inches. In situations with relatively high tally, it should only be necessary to check a few RCD’s.

Code	Definition
1	Stump sprout
2	Other seedling
3	Competitive oak, hickory, walnut, or butternut seedling

### Height Class

Each seedling is assigned a height class.

Code	Definition	Code	Definition
1	2 inches to 6 inches	4	3 feet to 5 feet
2	6 inches to 1 foot	5	5 feet to 10 feet
3	1 foot to 3 feet	6	Greater than 10 feet

### Numbers of Stems

Record the number of tree seedlings in each category described by species, seedling source, and height class. The first five seedlings of each species must be counted precisely. Counts above five may be estimated. In the case of beech root suckers, count all individuals unless they arise from a single root node, in which case they should be counted as a single stem.







## EXOTIC SPECIES SURVEY: TALLY PROCEDURES AND SPECIES LIST

### Overview

The Exotics Survey is being implemented on the Pennsylvania Regeneration Study (PRS) sample plots. The survey utilizes a list of invasive trees, vines, shrubs, flowers, and grasses developed from state and federal lists of invasive species associated with forest and forest-related habitats. Most of the species on the list are exotics; however, some natives are included. The Survey will identify PRS subplots where invasive species are found. Once complete, the results will provide an extensive view of invasive species distributions in Pennsylvania. Although the measurements are simple observations of occurrence, the results will indicate how many subplots the invasives occur on. These findings will supplement other studies of invasive species being conducted by cooperating institutions.

### Tally Procedures

The Exotics Survey is conducted at each sample location where PRS study measurements are conducted--on all forested conditions that are encountered. Tally procedures consist of examination of each subplot for occurrence of one of the species or species groupings listed on the Exotics Survey Tally Sheet. If the species is identified and is rooted within the subplot, list the subplot number next to each species or species group. There is no need to consider condition boundaries, except to confirm that the species is rooted within the forested portion of the subplot.

For example, the picture below illustrates the procedure for a tally of one Tree-of-heaven on subplot 1 and mile-a-minute vine on all four subplots.

EXOTICS SURVEY TALLY SHEET				
Date	Mo	Day	Yr	State
Crew	6	27	02	42
X = present	496	043		County
				Plot
				5484
Sub Plot #'s	Code	SCIENTIFIC NAME	COMMON NAME	NOTES
		<b>TREES</b>		
	9320	<i>Acer platanoides</i>	Norway maple	milky sap, buds not pointed like sugar maple, samaras spread at nearly 180°
X 1	9341	<i>Ailanthus altissima</i>	Tree-of-heaven	coarse twigs and pinnate leaves to 1m long
	9712	<i>Paulownia tomentosa</i>	Empress tree	leaves opposite or whorled, simple, blades broadly cordate-ovate, velvety pubescent on both sides
	9861	<i>Pyrus calleryana</i>	Bradford pear	leaves ovate, glossy, and somewhat leathery, leaf margins bearing round teeth
		<b>VINES</b>		
	9882	<i>Akebia quinata</i>	Fiveleaf akebia	leaves evergreen, alternate, palmately compound with 5 oval leaflets, problem in Philadelphia area
	9883	<i>Ampelopsis brevipedunculata</i>	Porcelain-berry	lobed leaves, tendrils without adhesive disks, fruit a bright blue berry
	9556	<i>Celastrus orbiculatus</i>	Oriental bittersweet	fruit in axis of leaves, (native sp. has fruit only at end of vine, fruit more yellowish in color)
	9884	<i>Hedera helix</i>	English ivy	evergreen vine climbing by means of aerial rootlets; leaves alternate, simple-3-5-lobed
	9636	<i>Lonicera japonica</i>	Japanese honeysuckle	hairy underside of leaf, young leaves fern like, (native vine-leaves waxy, no hairs, fused at base)
X 1,2,3,4	9885	<i>Polygonum perfoliatum</i>	Mile-a-minute vine	leaves triangular, barbs on leaf petioles and leaf midrib, slender annual vine
	9886	<i>Pueraria lobata</i>	Kudzu	leaves trifoliate, leaflets broadly ovate (syn <i>Pueraria montana</i> var. <i>lobata</i> )
	9887	<i>Vinca minor</i>	Common periwinkle	aka creeping myrtle; evergreen plant with creeping stems; leaves opposite, entire, blue flowers

Instructions for entering data on the Personal Data Recorders (PDR) is provided in the help screen of the PDR.

**Exotic Survey Species List**

The list of invasive species and species groups are as follows:

**Trees**

9320	Norway maple, <i>Acer platanoides</i>
9341	Tree-of-heaven, <i>Ailanthus altissima</i>
9712	Empress tree, <i>Paulownia tomentosa</i>
9861	Bradford pear, <i>Pyrus calleryana</i>

**Vines**

9882	Fiveleaf akebia, <i>Akebia quinata</i>
9883	Porcelain-berry, <i>Ampelopsis brevipedunculata</i>
9456	Oriental bittersweet, <i>Celastris orbiculatus</i>
9884	English ivy, <i>Hedera helix</i>
9636	Japanese honeysuckle, <i>Lonicera japonica</i>
9885	Mile-a-minute vine, <i>Polygonum perfoliatum</i>
9886	Kudzu, <i>Pueraria lobata</i>
9887	Common periwinkle, <i>Vinca minor</i>

**Shrubs**

9368	Japanese barberry, <i>Berberis thunbergii</i>
	European barberry, <i>Berberis vulgaris</i>
9535	Russian olive, <i>Elaeagnus angustifolia</i>
	Autumn olive, <i>Elaeagnus umbellata</i>
9888	Winged Euonymus, <i>Euonymus alatus</i>
9889	Border privet, <i>Ligustrum obtusifolium</i>
	Common privet, <i>Ligustrum vulgare</i>
9635	Bell's honeysuckle, <i>Lonicera morrowii</i> x <i>tatarica</i> (include only the honeysuckle species listed)
	Amur honeysuckle, <i>Lonicera maackii</i>
	Morrow's honeysuckle, <i>Lonicera morrowii</i>
	Standish honeysuckle, <i>Lonicera standishii</i>
	Tartarian honeysuckle, <i>Lonicera tatarica</i>
9845	Common buckthorn, <i>Rhamnus catharticus</i>
	Glossy buckthorn, <i>Rhamnus frangula</i>
9906	Multiflora rose, <i>Rosa multiflora</i>
9916	Wineberry, <i>Rubus phoenicolasius</i>
9938	Japanese spiraea, <i>Spiraea japonica</i>
9993	Linden viburnum, <i>Viburnum dilatatum</i>
9994	Guelder rose, <i>Viburnum opulus</i>

**Forbes and Grasses**

9890	Garlic mustard, <i>Alliaria petiolata</i>
9891	Spotted knapweed, <i>Centaurea maculata</i>
9892	Canada thistle, <i>Cirsium arvense</i>
	Bull thistle, <i>Cirsium vulgare</i>
9893	Crown-vetch, <i>Coronilla varia</i>
9894	Giant hogweed, <i>Heracleum mantegazzianum</i>

<b>9895</b>	Purple loosestrife, <i>Lythrum salicaria</i>
<b>9896</b>	Japanese stiltgrass, <i>Microstegium vimineum</i>
<b>9897</b>	Reed canary grass, <i>Phalaris arundinacea</i>
<b>9898</b>	Common reed, <i>Phragmites australis</i>
<b>9899</b>	Japanese knotweed, <i>Polygonum cuspidatum</i>
	Giant knotweed, <i>Polygonum sachalinensis</i>
<b>9900</b>	Other invasive plants observed (optional)

Mo		Day		Yr		INVASIVE SPECIES IN PENNSYLVANIA				State	42		
Date												County	
Crew												Plot	
X = present		SCIENTIFIC NAME		COMMON NAME		NOTES							
↓	Sub Plot	Code	TREES										
		1	Acer platanoides	Norway maple	milky sap, buds not pointed like sugar maple, samaras spread at nearly 180°								
		2	Ailanthus altissima	Tree-of-heaven	coarse twigs and pinnate leaves to 1m long								
		3	Paulownia tomentosa	Empress tree	leaves opposite or whorled, simple, blades broadly cordate-ovate, velvety pubescent on both sides								
		4	Pyrus calleryana	Bradford pear	leaves ovate, glossy, and somewhat leathery, leaf margins bearing rounded teeth								
<b>VINES</b>													
		5	Akebia quinata	Fiveleaf akebia	leaves evergreen, alternate, palmately compound with 5 oval leaflets, problem in Philadelphia area								
		6	Ampelopsis brevipedunculata	Porcelain-berry	lobed leaves, tendrils without adhesive disks, fruit a bright blue berry								
		7	Celastrus orbiculatus	Oriental bittersweet	fruit in axis of leaves, (native sp. has fruit only at end of vine, fruit more yellowish in color)								
		8	Lonicera japonica	Japanese honeysuckle	hairy underside of leaf, young leaves fern like, (native vine-leaves waxy, no hairs, fused at base)								
		9	Polygonum perfoliatum	Mile-a-minute vine	leaves triangular, barbs on leaf petioles and leaf midrib, slender annual vine								
		10	Pueraria lobata	Kudzu	leaves trifoliate, leaflets broadly ovate								
<b>SHRUBS</b>													
		11	Berberis thunbergii	Japanese barberry	single spine, leaf margins entire (native barberry extirpated from PA, last found in Huntington Co.)								
			or	Berberis vulgaris	European barberry compound spines mostly 3 pronged, leaves obovate with margins bearing very fine small spines								
		12	Elaeagnus angustifolia	Russian olive	leaves covered with silvery scales on both surfaces								
			or	Elaeagnus umbellata	Autumn olive leaves becoming green and glabrescent above								
		13	Euonymus alatus	Winged Euonymus	corky ridges on twigs. (native euonymus does not have corky ridges on twigs, much larger leaves)								
		14	Ligustrum obtusifolium	Border privet	Privet leaves opposite, with no leaf scar between leaves (there are no native privets)								
			or	Ligustrum vulgare	Common privet (Honeysuckles have leaf scar between leaves)								
		15	Lonicera morrowii x tatarica	Bell's honeysuckle	(Non-native bush honeysuckles have white flowers with white or hollow pith)								
			or	Lonicera maackii	Amur honeysuckle leaves ovate to lance-ovate, acuminate, not hairy, fruit dark red								
			or	Lonicera morrowii	Morrow's honeysuckle leaves oblong to narrowly elliptic, softly pubescent beneath, fruit orange to red								
			or	Lonicera standishii	Standish honeysuckle (Native honey suckles have yellow flowers)								
			or	Lonicera tatarica	Tartarian honeysuckle leaves ovate to oblong, glabrous beneath, fruit red								
		16	Rhamnus catharticus	Common buckthorn	edge plant, leaves opposite (native buckthorn never has spine, grows on wet limestone soils)								
			or	Rhamnus frangula	Glossy buckthorn grows in boggy areas, leaves alternate								
		17	Rosa multiflora	Multiflora rose	conspicuously fringed stipule at base of leaf petiole								
		18	Rubus phoenicolasius	Wineberry	dense very fine bristles on stems								
		19	Spiraea japonica	Japanese spiraea	much larger leaves than native sp. and flowers flat topped, native sp has columnar flowers								
		20	Viburnum dilatatum	Linden viburnum	leaves coarsely toothed, pubescent on both sides								
		21	Viburnum opulus	Guelder rose	Resembles native Viburnum trilobum, has concave-topped petiolar glands vs. dome shaped for trilobum								
<b>FLOWERS AND GRASSES</b>													
		22	Alliaria petiolata	Garlic mustard	white four petal flowers, crushed leaves smell like garlic								