

## Forest Regeneration Assessment Series

# 3 | Evaluating Stand Conditions: Implementing and Interpreting the Regeneration Assessment





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*This material is based upon work supported by  
the Natural Resources Conservation Service,  
US Department of Agriculture, under NRCS  
Conservation Innovation Grant 16-042.*

## Introduction

The second publication in this series, *What's Getting in the Way of Your Woodland's Potential to Regenerate?*, provided the background for understanding the need to establish and foster adequate tree regeneration. This understanding begged the question: "What conditions exist in my woodlands?" Answering this depends on conducting a systematic evaluation or assessment of stand-level conditions. This third publication in this series presents a specific protocol and methods for collecting data to guide your understanding of existing conditions using a stand-level decision tree to reach a determination. At that point, before undertaking any actions, you should consult with a resource professional to thoroughly consider appropriate management actions.

As a reminder in the second publication, specific **PROTOCOLS** were highlighted. It may prove useful to refer back to these to understand the reason for collecting specific data.

The assessment described here uses "plots" to collect data to answer questions related to:

- Light conditions
- Competitive plants
- Deer impacts

This information will then feed into a decision key designed to suggest apparent reasons for regeneration success or failure in chosen stands and across your woodlands. Recall, again, that the stand is the assessment unit. A "stand" is a contiguous, distinguishable group of trees of similar age distribution, species, structure, site, and history such that it is recognized as a unit. A landowner might even recognize and name these areas as the hemlocks, the old orchard, the oak ridge.

Before moving ahead with reading the following assessment process, take the time to outline your stands on a property sketch or aerial photograph printed from the internet. Having done that, you can begin to fill in the first few lines of the Assessment Tally Sheet. Specifically,

1. the name or number you have given the stand on your map,
2. how many stands you have identified, and
3. approximate acres each stand represents.

# Assessment Procedures

## Laying Out the Assessment

Before you collect data, walk through the chosen stand and consider the size of the area and the variability in both the overstory and understory vegetation. This exercise will help determine how many plots to take and where to collect data within the stand.

If the chosen stand is large and there is variation in the vegetation, consider dividing the stand into sub-stands of similar conditions and conducting a separate assessment in each sub-stand. For example, if there are noticeable differences in the vegetation (one area has a high proportion of oak and a carpet of small oak seedlings, another has a high proportion of beech/hemlock and scarce regeneration), these areas are separate stands.

Within each individual stand, determine how many plots to take. Table 1 shows the minimum number of plots for stands of different sizes; taking more plots increases the reliability of the results. Foresters usually take more plots to obtain an accurate assessment of overstory and understory conditions from which to develop silvicultural prescriptions. Often, the number of understory plots is twice the number of overstory observations since understory conditions frequently are more variable than overstory conditions. Confidence in the assessment results and the accuracy of your information will increase as you increase the number of plots.

Where do you locate the plots? Again, consider the size and variability of the stand. Choose a route through the stand (you can double back in large areas) that spaces plots evenly throughout the stand.

Try not to “choose” plot locations because they are easier to measure or because there are more trees there. If you do, this will bias the results. Do not locate a plot so that it includes an existing road, forest edge, or anything that makes the plot unique or does not represent variation in the stand.

Sometimes it helps to lay out the plots in advance of entering the stand, using GIS to randomly generate plots or establishing plots on a grid at set distances apart. Using pre-established plots helps ensure you don’t bias your sample by only choosing the “ideal” conditions.

Table 1. Minimum Number of Plots for Assessing Stand Regeneration (additional plots increase accuracy)

Stand Area (estimated)	Minimum Number of Plots per Stand
25 acres or less	5
26-100 acres	10
101-200 acres	15
more than 200 acres	20

At each plot, use the same plot center for both the understory and overstory plots. Overstory estimates use the 1/10<sup>th</sup> acre plot (a circular plot with a radius of 37.2 feet), and understory data are collected on both the 1/10<sup>th</sup> acre plot and the 1/1,000<sup>th</sup> acre (milacre) plot (a circular plot with a radius of 3.72 feet). The first few times you measure plots, use a measuring tape or marked rope to measure the plot’s limits. With practice, it is possible to assess this distance without measuring every time. However, it is useful to check yourself periodically. Figure 1 shows how to lay out each combination overstory/understory plot.

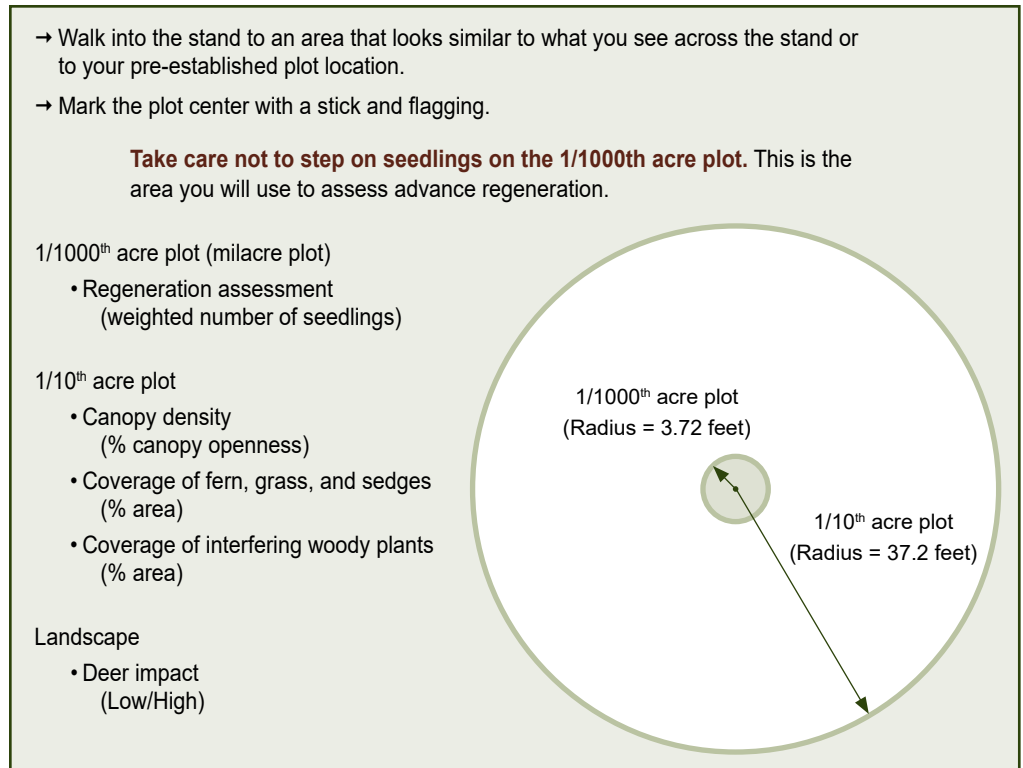
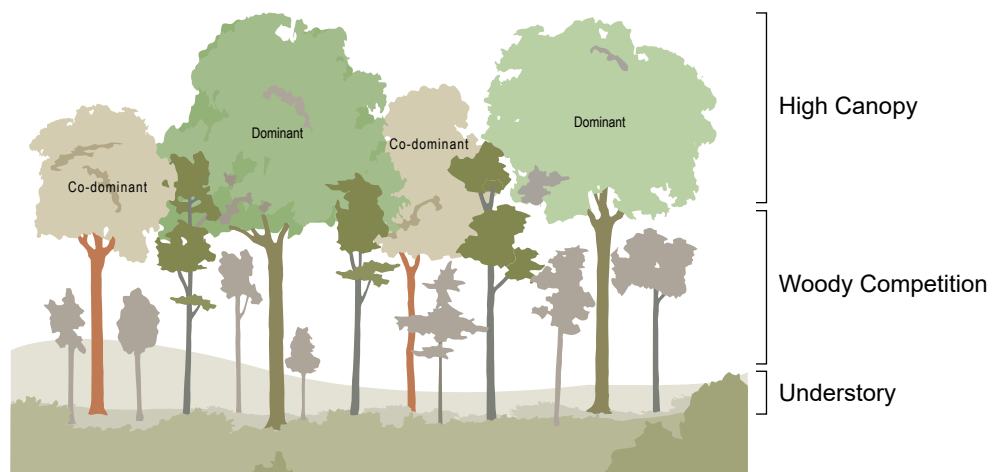


Figure 1. Establishing a Plot Layout

### Stand Structure and Composition Assessment

Stand structure and composition are two components used to describe forest conditions. Structure relates to the vertical and horizontal arrangement of trees within a stand or across a forest, as shown in Figure 2. Structure can provide insights into light distribution. A stand with only a high canopy lacks vertical structure and, depending on the horizontal distribution of trees, this influences canopy closure and thus light distribution. As vertical structure increases or is more complex, lower trees or plants intercept more of the light resource, and the horizontal structure can affect light patterns lower in the structure or on the forest floor.



Adapted from: Kays, J., Downing, A.K., Finley, J. et al. 2015. *The Woods in your Backyard*, 2<sup>nd</sup> Edition. Plant and Life Sciences Publishing, New York.

Figure 2. Vertical Structure of a Stand

Composition provides a description of species. Starting with the high canopy, species provide information on how the structure developed (e.g., tolerance and competition for light), past management activities (e.g., what is there and what is missing), and seed source potential.

The Woody Competition structural layer describes a point where shade density has a larger impact on light resources (i.e., the umbra and penumbra light conditions, see Stand Structure and Composition in *Forest Ecology: How a Forest Grows*). Again, understanding species composition reflects on how this structural layer developed and its effect on regeneration. In many stands, the impact of exotic species is increasingly apparent. To help focus on this challenge, it may prove helpful to separate and identify native and exotic woody species during the assessment. It is also important to determine what you want to consider as competitive or desirable woody structure in this layer. For example, foresters would consider any striped maple and American beech root suckers competitive and include them in this competitive assessment. Depending on the landowner's interest, crabapple or juneberry might be desirable and not considered competitive. This point will carry forward into the regeneration tally on the 1/1000<sup>th</sup> acre plot.

The final layer in the vertical structure is the understory, which considers three components that have the capacity to create low shade: ferns, grass/sedges, and herbaceous plants. Not all ferns are a concern. The intent here is to identify and assess ferns that spread through rhizomes, which results in individual separate fronds, not groupings. Fern species of concern are New York, hayscented, and bracken. Grasses and sedges combine into one competitive layer. For identification, grasses have round stems and sedges have "V" or triangular shaped stems. Knowing the difference relates to soil moisture and the potential for water to increase on the site following disturbance – sedges indicate elevated soil moisture or its potential. Herbaceous plants (i.e., soft tissue annual, biennial, or perennial broadleaf plants) do create impactful shade and increasingly these are non-native species. Consider noting the percentages of native and exotic during the assessment.



*New York, hayscented, and bracken fern species can quickly cover large areas of the understory.*

#### Action Steps:

1. Assess canopy closure by calculating the percentage of blue sky that would remain if you were to aggregate the high canopy into quadrants (the example in Figure 3 has 50% blue sky, or 50% canopy closure). Record the percent of canopy closure and the species of the canopy trees on the Regeneration Assessment Plot Data sheet included in Appendix A.

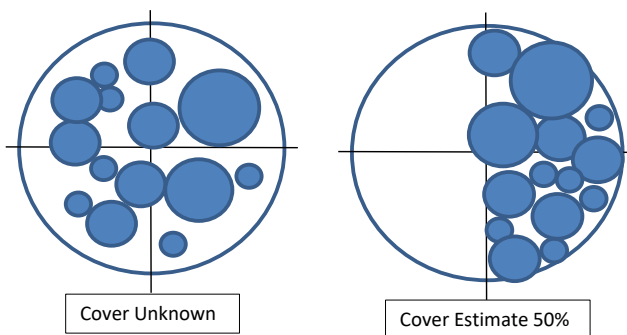


Figure 3. Example of Calculating Canopy Closure

2. Looking at the midstory (the area 1 to 30 feet above the ground), do the same closure calculation on the mid-canopy as you did on the high canopy, determining the percentage of the plot that has midstory coverage. Optionally, indicate whether these are native or exotic and record the species.
3. Record the percentage of the 1/10<sup>th</sup> acre plot that has fern, grass/sedges, or herbaceous cover and note species as you can.

**Assessment Tip:** All of the variables in this portion of the assessment involve estimating percent cover. It is useful to look at the plot in quarter-pie shaped wedges. Then, mentally fill the wedges with cover until it is all consolidated to assign percent cover. It is also useful to work in 5% increments. Use 5% as the starting point for any category present, which serves as notice that there is something there. Then work up in 5% increments. The second tip is to not overlap cover types. For example, ferns move with ferns, grasses move with grasses.

**Assessment Tip:** Figure 4 shows an example of how data entries are made on the top part of the Regeneration Assessment Plot Data Sheet included in Appendix A.

**Regeneration Assessment  
Plot Data**

Plot 1 of 5 Stand Name or Number: Good Oak

1/10<sup>th</sup> Acre (37.2 foot radius) Stand Structure and Composition:

Canopy Closure: 50 % closed

High Canopy Composition: red oak, white oak, sugar maple, red maple

Woody Competition (1 to 30 feet): Total 20 % covered (Optional: 15 % native, 5 % exotic)

Native Woody Composition: striped maple, spicebush

Exotic Woody Composition: Japanese barberry

Fern Cover: 15 % Grass/Sedge Cover: 5 %

Herbaceous Cover: 50 % (Optional: 5 % native, 45 % exotic)

Native Herbaceous Composition: cohosh

Exotic Herbaceous Composition: garlic mustard

Figure 4. Example of 1/10<sup>th</sup> acre Plot Data Entries

### Regeneration Assessment Procedure

Having collected stand structure and composition data on the 1/10<sup>th</sup> acre, the assessment shifts to the 1/1000<sup>th</sup> acre (i.e., milacre plot). These are small plots and the data collected on them expands to reflect stocking at the acre and then the stand level. Because of this expansion, it is important to carefully tally regeneration; however, note the regeneration tally does not differentiate species. It is therefore important to establish desirable and undesirable regeneration, where the latter is captured in the woody competition layer assessment discussed above.

Regeneration assessment is challenging, as it is sometimes difficult to know if a tiny plant is desirable or undesirable or even if it is a tree. The best advice is to give it a shot. With time, confidence will build. It is best to conduct this assessment with leaves on.

To conduct the regeneration assessment on the milacre plot, make a “stick” about 4 feet long, using wood or ½-inch PVC pipe. Mark off the plot radius (3.72 feet or 3 feet, 9 inches). The additional length works well for a handle. Hold the handle mark at the previously marked plot center and swing the circle, tallying regeneration as encountered, calling out the heights for a partner to record using the Dot Tally System shown in the following assessment tip.

**Assessment Tip:** Dot Tally System – Keeping count of data is always a challenge in the field. Foresters use the 10-dot system shown in Figure 5 below to rapidly record and summarize tallies.

1	2	3	4	5	6	7	8	9	10
•	• •	• • •	• • • •	—	┌	└	□	◻	⊗

Figure 5. 10-dot Tally System Used by Foresters

### Recording Regeneration Assessment Data

Appendix A contains a blank plot tally sheet for recording data for a single regeneration plot. Make or print sufficient copies to conduct the assessment in each stand assessed. Record the dot tally in the blank line beneath each height group. Note the intervals do not overlap (e.g., 2 in. to < 1 ft., where “<” means “less than”). In the shaded line below the dot tally line, enter the dot count in the equation times the multiplier (e.g., 20 for 3 ft. to < 5 ft. seedlings). Then, add the numbers across and enter the sum in the Weighted Row Column. (See Figure 6 for an example of the dot tally and weighted regeneration calculation.) The next important question is Deer Impact, which is either High or Low, which require counts of 50 or 15, respectively. The actual score is then reduced to an “X” indicating adequate regeneration is occurring on the plot, or left blank indicating inadequate regeneration on the plot. The goal is to have 70% of all plots showing an adequate regeneration rating. In the case of five plots, err on the conservative side and expect four to have adequate stocking.

Note it is unnecessary to record species in the table; however, it is good to note those species considered desirable in the tally in the space provided.

**Assessment Tip:** Figure 6 shows an example of how data entries are made in the table at the bottom of the Regeneration Assessment Plot Data Sheet for a plot with high deer impact.

Plot Regeneration Tally, 1/1000<sup>th</sup> Acre Data (3.72 foot radius)

Tally and Weighting	Tally and Weighting	Tally and Weighting	Tally and Weighting	Weighted Row	Score Adequate
2 in < 1 ft	1 ft < 3 ft	3 ft < 5 ft	> 5 ft		High Deer > 50 Low Deer > 15
⊗	• •	•			
1 x 10 = 10	2 x 5 = 10	20 x 1 = 20	50 x 0 = 0	40	

Figure 6. Example of 1/1000<sup>th</sup> acre Plot Data Entries



## Data Summary

Indicate the Stand Development Stage as identified by stand traits. As a refresher, take a look at Table 1 on page 5 of *What's Getting in the Way of Your Woodland's Potential to Regenerate?* Assess white-tailed deer impact and record high or low impact on the assessment worksheet, based on your observations. Low indicates the existence of varying heights of preferred woody regeneration and spring indicator wildflowers are present, flowering, and producing seeds. High impact is anything above that threshold.

Upon completing data collection on the assessment plots in a given stand, return to the Stand Cover Sheet to record and summarize the plot data in the table at the bottom of the sheet. Figure 7 shows an example of a completed Stand Cover Sheet for five plots. Recall that deer impact is a stand level measure and record Low or

### Regeneration Assessment Stand Cover Sheet

This page serves as a summary for all of the plots taken within the stand

Stand Name: Good oak

Approximate Area: 5 acres

Estimated Number of Plots: 5 plots

Stand Development Stage (circle one):

Initiation      Stem Exclusion      Understory Reinitiation      Complex/Mature

White-tailed Deer Impacts

	1	2
Preferred Species Present?	No	<u>Yes</u>
Browse Line?	<u>Yes</u>	No
Cropped Regeneration?	<u>Yes</u>	No
Spring Indicator Wildflowers?	<u>No</u>	Yes

1 or more answers circled in column 1 = HIGH pressure; no answers circled in column 1 = LOW pressure

Deer Impact = HIGH | LOW

Stand Description, History, and Notes: Maybe formed at one time, tall trees, red oak and white oak are tallest. More red oak than white oak.

### Plot Data Summary (10 plots)

1	2	3	4	Competitive Plants				9	10
				5	6	7	8		
Plot No.	Deer High? Low?	Regen Score	% Canopy Density	% Woody	% Fern Cover	% Grass/Sedge	% Herbaceous	Interference Sum	Any Interference (Check)
1		40	50	20	15	5	50	90	✓
2		20	85	20	0	5	20	45	
3		15	90	15	0	10	60	85	✓
4		50	50	10	30	10	40	90	✓
5		10	70	20	30	0	30	80	✓
6									
7									
8									
9									
10									
	High	% Adequate 20	% Average 69	% Average 17	% Average 15	% Average 6	% Average 40		

Figure 7. Example Stand Cover Sheet

High in the space at the bottom of Column 2. Regeneration Score (Column 3) is the weighted score calculated on the plot regeneration tally sheet. Depending on deer impact, determine the percent of plots that have adequate stocking. Enter this percentage at the bottom of the column. Enter the individual plot values from the Percent Canopy Density (Column 4). Note this value is the average across the stand; enter that calculated average at the bottom of the column.

For the remaining columns (i.e., 5 through 8) enter the percent cover for each regeneration plot. Sum these values across the plot rows and enter that sum in Interference Sum (Column 9). If any of these sums are 30% or more, put a check in Any Interference (Column 9). While it is not necessary, it is useful to calculate an average for each of the competing vegetation columns. This average points toward the relative importance of each of the competition measures, which will help inform management decisions and activities.

### Interpreting the Data Summary by the Columns

**Deer Impact (Column 2):** This is either Low or High. This measure sets the stage for interpreting regeneration adequacy determined by the Regeneration Score.

**Regeneration Score (Column 3):** The column summary provides a way to assess regeneration distribution or evenness across the stand. The goal is to have 70% or more of the plots meet or exceed the score based on deer impact.

**Percent Canopy Density (Column 4):** The average canopy density calculated for this column again reflects light distribution and evenness across the stand. The threshold for this measure is 50%. If the average is above 50%, then canopy openness is generally insufficient to initiate or sustain regeneration of tree species classified as intermediate or intolerant of shade. It is possible to retain some shade tolerant species under more than 50% crown density.

**Competitive Plants (Columns 5 - 8):** The column summary average for each of the competitive plant types (i.e., Woody, Fern, Grass/Sedge, Herbaceous) provides one assessment measure, where a value of 30% or more is a significant concern. First, it occupies at least a third of the site, and with increased light, these species have the capacity to expand as they are seldom desirable white-tailed deer browse species.

**Interference Sum (Column 9):** This column provides a way to assess the sum impact of all competitive plant types by summing across plot rows (e.g., starting with Plot 1, Column 1). Enter the row sum value in Column 9. The threshold of concern is 30%. If any of the rows sum to 30% or more, enter a check in Any Interference (Column 10). If 30% of the plot rows equal or exceed 30% coverage, this is a concern. As stated above, 30% coverage by competitive plants suggests significant competition for light and raises concern there is the possibility that competitive plants are now an impediment to regeneration.

Clearly there are trade-offs in achieving desirable regeneration. Suppose all of the measurements (i.e., ferns, grass/sedge, herbaceous, and woody) are low and below the 30% concern threshold. This is in principle good; however, if all of them are present and close to the threshold, caution is warranted as increased light will certainly spur their expansion, especially if the regeneration score is already low.

## Interpretation Dichotomous Key

This dichotomous key, shown in Figure 8 and included in Appendix B, walks you through the stand conditions you've just summarized and indicates where problems might occur. Recommended actions based on your observations are color-coded in the rightmost column. Note that many of the situations end in a yellow or red square, indicating that the challenges to obtaining successful regeneration are great. As

Item	Description	Go to:
1	Deer impact is high	Go to 2
	Deer impact is low	Go to 7
2	Regeneration is adequate	Go to 3
	Regeneration is inadequate	Go to 4
3	Canopy closure is >50% (light inadequate)	Open canopy to release established regeneration. Monitor impacts of deer and competing vegetation and control as needed. Seek assistance.
	Canopy closure is <50% (light adequate)	Monitor impacts of deer and competing vegetation.
4	Canopy closure is >50% (light inadequate)	Go to 5
	Canopy closure is <50% (light adequate)	Go to 6
5	Interfering vegetation is >30%	Control deer or exclude from the stand. Control competing vegetation prior to opening the canopy to attempt to establish regeneration. Seek assistance.
	Interfering vegetation is <30%	Monitor competing vegetation. Control deer or exclude from the stand prior to opening the canopy to attempt to establish regeneration. Seek assistance.
6	Interfering vegetation is >30%	Control deer or exclude from the stand. Control competing vegetation. Lots of hard work ahead. Seek assistance.
	Interfering vegetation is <30%	Control deer or fence to exclude from the stand. Monitor competing vegetation. Assess potential seed source. Seek assistance.
7	Regeneration is adequate	Go to 8
	Regeneration is inadequate	Go to 9
8	Canopy closure is >50% (light inadequate)	May need to open the canopy to release the established regeneration. Monitor deer impact and competing vegetation. Control plants and deer as needed. Seek assistance.
	Canopy closure is <50% (light adequate)	Monitor deer impact and competing vegetation. Control deer and plants as needed.
9	Canopy closure is >50% (light inadequate)	Go to 10
	Canopy closure is <50% (light adequate)	Go to 11
10	Interfering vegetation is >30%	Control plants prior to opening the crown. Retain overstory species diversity as seed source. Monitor deer impacts. Seek assistance.
	Interfering vegetation is <30%	Create light conditions that will allow regeneration to establish by opening the canopy. Monitor competing vegetation and deer impact. Control deer and plants as needed. Seek assistance.
11	Interfering plants are >30%	Control competitive vegetation. Monitor for deer impacts. Seek assistance.
	Interfering plants are <30%	The lack of regeneration is likely a site-related variable, e.g., soil quality, soil moisture. Seek assistance.
<div style="display: flex; justify-content: space-between; align-items: center;"> <span style="background-color: #00b050; color: white; padding: 2px 5px;">Green = Sustainable</span> <span style="background-color: #ffff00; color: black; padding: 2px 5px;">Yellow = Caution and Seek Assistance</span> <span style="background-color: #ff0000; color: white; padding: 2px 5px;">Red = Stop and Seek Assistance</span> </div>		

Figure 8. Interpretation Dichotomous Key

you work your way through the key and the next Taking Action section, you'll see that there are actions you can take to help create regeneration. It just will take some intervention.

## Taking Action

The step-by-step regeneration assessment has two objectives:

1. To help woodland owners conduct a basic evaluation of their woodlands, and,
2. To identify actions that might improve chances for successful forest regeneration.

After conducting the assessment, complete the Plot Data Summary on the Stand Cover Sheet. This table points to barriers to attaining successful regeneration, namely, competing vegetation (invasive plants or other), deer, and light. What are your next steps for addressing identified regeneration challenges?

### Reducing Deer Impact

If you identified deer as a concern, consider these four common strategies:

- Fencing the stand
- Fencing individual seedlings
- Fencing small areas (100 ft<sup>2</sup> circles of 4 ft fence) to evaluate deer influence
- Increase hunting activity (e.g., Pennsylvania Game Commission Deer Management Assistance Program, local cooperative efforts)

Consider becoming a member of a woodland owners association. Find an association near you by visiting <https://tinyurl.com/y8ho88tt>. You may benefit from others' experiences – obtaining advice on many topics, including effective fencing strategies, where to find materials, and other practical considerations. Seek advice from your county USDA Natural Resource Conservation Service (NRCS) office, as well as your county PA DCNR service forester or consulting forester.

### Presence/Absence of Tree Seedlings (Advance Regeneration)

You may have adequate tree seedlings established. If not, determining appropriate stewardship activities may require professional guidance. Contact your county PA DCNR service forester or trusted consulting forester for advice. Trained and experienced foresters can offer insight and suggest activities to ensure successful regeneration.

### Canopy Cover

Canopy density is key to establishing and releasing advance regeneration. Recall, 50% blue sky is the regeneration threshold for regenerating intolerant tree species. Deciding to change canopy structure is a big stand-changing event. Contact your service forester or consulting forester for advice on planning thinning or harvest operations. A forester working for you can recommend stewardship activities that will encourage successful regeneration and practices supporting landowner values and objectives. Be clear in stating your values toward your woodlands and your long-term goals for the property. As well, listen for the forester's interest in addressing any and all issues identified in the regeneration assessment and for a focus on attaining regeneration success.

## Competition from Other Vegetation

If your assessment showed issues with competing vegetation, this may require aggressive intervention; however, timing is critical. Sometimes landowners identify competing vegetation problems and institute control measures without considering the stand development stage or whether there are pending management activities that might create light conditions to foster regeneration. Controlling competing vegetation can involve hand pulling, hand or machine applied herbicides, or cultural activities (e.g., prescribed fire).

Exotic competitive plants are difficult to control once established. The sooner addressed, the better. If left alone, exotic plants will spread, especially when new openings create additional light into the forest. The temptation is to jump into the thick of it and tackle the biggest problems when it may be easier and more useful to address fringes and smaller patches to limit spread. After controlling smaller patches and gaining experience, focus efforts on larger, denser patches.

Your service forester, consulting forester, or a local woodland owners association may have advice on controlling competing vegetation. For more information about where to start with invasive plant control, visit <https://extension.psu.edu/herbicides-and-forest-vegetation-management>.

## Creating Openings without Unintended Harm to the Stand

In any thinning or harvest activity affecting canopy structure, it is important to retain seed source, especially if advance regeneration is lacking. Science-based silvicultural prescriptions provide detailed guidelines for reserving seed source, spacing, light requirements, and mitigating the influences of competitive plants and deer. The tendency too often is to use tree size-based approaches that take the best trees and leave the rest. This logging practice removes the most economically valuable trees. The term “select cut” or “diameter cut” seems to describe a modest, low-impact harvest. The logic is that the big diameter trees are old and the small diameter trees are young, which is seldom the case. Cut this way, several things happen. First, the species composition changes as the intolerant species are often the largest and that seed source is lost or greatly reduced. Second, the average stand diameter drops, which normally means that it will take longer to regain enough growth to schedule another harvest. Third, since the focus is on the best, the “losers” are often left. This type of cut significantly alters woodland health as it removes the best seed sources, leaving a degraded stand or woodland.

## Other Considerations for Planning

Before deciding how to meet or enhance your values and objectives, it is important to understand where the forest is in its development. If the number of seedlings counted was inadequate for successful regeneration, consult with a forester (Pennsylvania DCNR Service Forester, an accredited Consulting Forester, or an NRCS Forester) for recommendations on specific actions to foster successful regeneration. Control competitive plants first. Next, explore options for controlling or minimizing deer impact. Lastly, work with the canopy structure to manage light for tree seedling establishment.

## For Further Assistance

Contact the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) Bureau of Forestry:

717-787-2703

[www.dcnr.pa.gov/Conservation/ForestsAndTrees/  
ManagingYourWoods/Pages/default.aspx](http://www.dcnr.pa.gov/Conservation/ForestsAndTrees/ManagingYourWoods/Pages/default.aspx)

for a list of county service foresters, to request a free visit and consultation, and other resources.

Contact the US Department of Agriculture Natural Resource Conservation Service (NRCS) office in your county for possible cost-share opportunities. Applications for assistance through the Farm Bill program called EQIP (Environmental Quality Improvement Program) are accepted on a yearly basis. You may be eligible for assistance with a variety of practices that can improve the success of regeneration in your woodland. Find your local service center in the online directory:

[www.nrcs.usda.gov/wps/portal/nrcs/main/pa/contact/local/](http://www.nrcs.usda.gov/wps/portal/nrcs/main/pa/contact/local/)

or by finding your local Conservation District office in the phone book.

## APPENDIX A

Regeneration Assessment Plot Data Sheet  
Stand Cover Sheet





## Regeneration Assessment Plot Data

Plot \_\_\_\_ of \_\_\_\_

Stand Name or Number: \_\_\_\_\_

1/10<sup>th</sup> Acre (37.2 foot radius) Stand Structure and Composition:

Canopy Closure: \_\_\_\_\_ % closed

High Canopy Composition: \_\_\_\_\_

Woody Competition (1 to 30 feet): Total \_\_\_\_\_ % covered (Optional: \_\_\_\_\_ % native, \_\_\_\_\_ % exotic)

Native Woody Composition: \_\_\_\_\_

Exotic Woody Composition: \_\_\_\_\_

Fern Cover: \_\_\_\_\_ % Grass/Sedge Cover: \_\_\_\_\_ %

Herbaceous Cover: \_\_\_\_\_ % (Optional: \_\_\_\_\_ % native, \_\_\_\_\_ % exotic)

Native Herbaceous Composition: \_\_\_\_\_

\_\_\_\_\_

Exotic Herbaceous Composition: \_\_\_\_\_

\_\_\_\_\_

### Plot Regeneration Tally, 1/1000<sup>th</sup> Acre Data (3.72 foot radius)

Tally and Weighting	Tally and Weighting	Tally and Weighting	Tally and Weighting	Weighted Row	Score Adequate
2 in < 1 ft	1 ft < 3 ft	3 ft < 5 ft	> 5 ft		High Deer > 50 Low Deer > 15
1 x ____ =	2 x ____ =	20 x ____ =	50 x ____ =		

Regeneration Species Composition: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



## APPENDIX B

### Interpretation Dichotomous Key



Item	Description	Go to:
1	Deer impact is high	Go to 2
	Deer impact is low	Go to 7
2	Regeneration is adequate	Go to 3
	Regeneration is inadequate	Go to 4
3	Canopy closure is >50% (light inadequate)	Open canopy to release established regeneration. Monitor impacts of deer and competing vegetation and control as needed. Seek assistance.
	Canopy closure is <50% (light adequate)	Monitor impacts of deer and competing vegetation.
4	Canopy closure is >50% (light inadequate)	Go to 5
	Canopy closure is <50% (light adequate)	Go to 6
5	Interfering vegetation is >30%	Control deer or exclude from the stand. Control competing vegetation prior to opening the canopy to attempt to establish regeneration. Seek assistance.
	Interfering vegetation is <30%	Monitor competing vegetation. Control deer or exclude from the stand prior to opening the canopy to attempt to establish regeneration. Seek assistance.
6	Interfering vegetation is >30%	Control deer or exclude from the stand. Control competing vegetation. Lots of hard work ahead. Seek assistance.
	Interfering vegetation is <30%	Control deer or fence to exclude from the stand. Monitor competing vegetation. Assess potential seed source. Seek assistance.
7	Regeneration is adequate	Go to 8
	Regeneration is inadequate	Go to 9
8	Canopy closure is >50% (light inadequate)	May need to open the canopy to release the established regeneration. Monitor deer impact and competing vegetation. Control plants and deer as needed. Seek assistance.
	Canopy closure is <50% (light adequate)	Monitor deer impact and competing vegetation. Control deer and plants as needed.
9	Canopy closure is >50% (light inadequate)	Go to 10
	Canopy closure is <50% (light adequate)	Go to 11
10	Interfering vegetation is >30%	Control plants prior to opening the crown. Retain overstory species diversity as seed source. Monitor deer impacts. Seek assistance.
	Interfering vegetation is <30%	Create light conditions that will allow regeneration to establish by opening the canopy. Monitor competing vegetation and deer impact. Control deer and plants as needed. Seek assistance.
11	Interfering plants are >30%	Control competitive vegetation. Monitor for deer impacts. Seek assistance.
	Interfering plants are <30%	The lack of regeneration is likely a site-related variable, e.g., soil quality, soil moisture. Seek assistance.
Green = Sustainable		Yellow = Caution and Seek Assistance
		Red = Stop and Seek Assistance







- THE CENTER FOR -  
PRIVATE FORESTS

The Center for Private Forests at Penn State  
416 Forest Resources Building  
University Park, PA 16802  
(814) 863-0401

[ecosystems.psu.edu/private-forests](http://ecosystems.psu.edu/private-forests)



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*This material is based upon work supported by the Natural Resources Conservation Service, US Department of Agriculture, under NRCS Conservation Innovation Grant 16-042.*



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Department of  
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