Forest Service's Northern Research Station FIA Launches 24-State Study of Forest Regeneration

By Will McWilliams, Shawn Lehman, Paul Roth, and Jim Westfall

Inventory foresters often quake when asked to count tree seedlings, because the work is tedious and sometimes means tallying hundreds of stems. They also know that the density and quality of advance regeneration are key to the success of new stand establishment. Seedling counts provide valuable information on regeneration adequacy, forest diversity, wildlife habitat, and the sustainability of native forests. In response to a general lack of information on advance regeneration at the landscape level, the US Forest Service's Northern Research Station's Forest Inventory and Analysis (NRS-FIA) program has launched a region-wide study (24 states) that includes complete measurement of regeneration.

The FIA program has traditionally counted seedlings, but the counts have included only stems at least one foot tall for hardwoods and six inches for softwoods. Silviculturists have long known that advance regeneration is critical for stand replacement after harvesting or major disturbances, and that information requirements include seedlings that have persisted for at least one year. Information that has been missing in the FIA inventory are the number of all seedlings, the degree of establishment, seedling height, the amount of "competing vegetation," and if there are other factors that limit the seedling survival, such as deer browse. When coupled with other FIA variables describing competing vegetation, overstory composition/structure, and stocking levels, a full composite of forest dynamics can be developed.

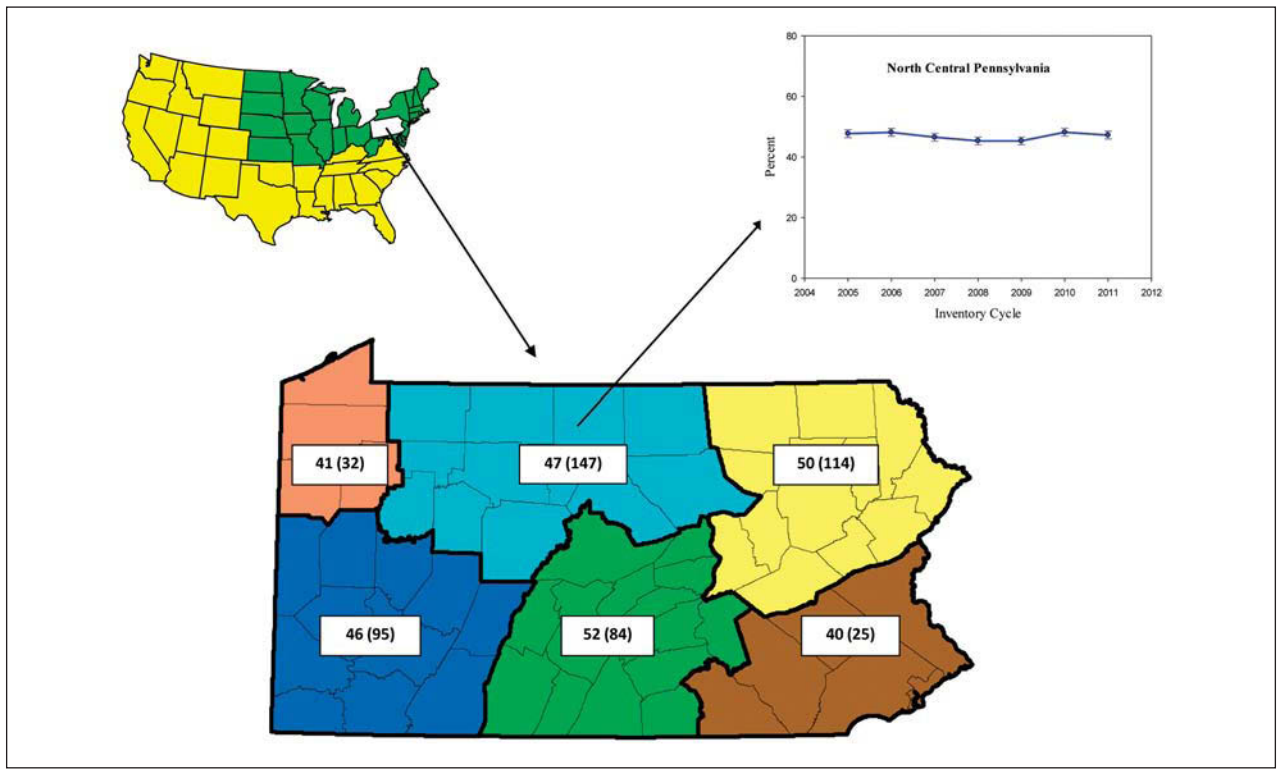

Figure 1. Percent and number (in parentheses) of plots adequately stocked with advance regeneration for plots 40 percent to 75 percent stocked with trees, Pennsylvania (2011) and Pennsylvania's North Central Region (2005 to 2011).

NRS-FIA has been measuring advance regeneration for more than a decade as part of a special study funded by the Pennsylvania Bureau of Forestry. The goal of the Pennsylvania Regeneration Study (PRS) has been to quantify the capacity of the state's maturing forest to regenerate following planned or unplanned disturbance. Pennsylvania has a long history of regeneration challenges, and other states have recently expressed support and growing interest in regeneration measurements. The reason is that the region's forests are maturing, and regeneration is severely challenged by browsing, competition from native and exotic invasive plants, pests, and climate. Management prescriptions for new stand establishment in Pennsylvania often call for herbicide application, deer fencing, and other practices that are very expensive, particularly for private forest owners with limited funds. Private forest land dominates the northern region, making this a very important issue. In response, the PRS measurement protocols were accepted for implementation across the NRS-FIA region, from North Dakota to Maine and south to Missouri and West Virginia, beginning with the 2012 field season.

Regeneration measurements are conducted on standard NRS-FIA plots visited during the leaf-on season to ensure correct species identification. The plots are tied to NRS-FIA's annual inventory design, in which 20 percent

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of a state's plots are measured each year, or a five-year measurement cycle. Measurements include a detailed tally of all seedlings two-inches tall and larger by species and height class. The protocols include measuring root collars for large-seeded species (oak and hickory) to qualify as "established" or "competitive." For example, established oak seedlings are defined as having a root-collar diameter (RCD) of at least 0.25 inches. Oak seedlings qualify as competitive if RCD is at least 0.75 inches. Each sample location is assigned an ocular estimate of deer browse impact, with categories ranging from 1 (low) to 5 (high). Sample locations can then be classified according to the proportion of plots with adequate regeneration. So far, guidelines for regeneration adequacy for the Mid-Atlantic region have been used, but plans include incorporating accepted silvicultural guidelines across the 24-state region in the future. The results are typically presented for plots that are in a range of stocking, in which seedlings should be able to establish and develop, with 40 percent to 75 percent overstory stocking. This information can then be used along with data on native and non-native competing vegetation and other FIA variables. To illustrate, the percentage of plots with adequate advance regeneration in Pennsylvania is only 47 percent, plus or minus 2 percentage points at a 67 percent confidence level. The level of adequacy does not vary much across the state and trends show little improvement over time (see Figure 1).

New information on the status and trends in forest regeneration will fill a number of needs for scientists and policymakers concerned about long-term forest sustainability. In terms of research and development, the results will help guide efforts aimed at improving forest regeneration and understanding the complexities of overall forest dynamics. Modelers are interested, because tree regeneration data at FIA's large geographic scale have not been available outside of Pennsylvania. For example, the Forest Vegetation Simulator tool is used by national forest managers and others to model stand dynamics and evaluate current and future stand character, but primarily uses stump sprout models to estimate forest regeneration for the Northeast variant if actual regeneration is not known. This is a significant limitation, because most of the region's cover types rely on natural regeneration as the primary means for establishing new stands.

Managers and decisionmakers need information on stand dynamics to evaluate decisions and policies directed toward long-term sustainability. One example has been the use of PRS findings as the primary measure of the quality of deer habitat in Pennsylvania. This approach has been used by wildlife managers to assist in determining deer-harvest levels, with the goal of improving deer-herd and forest-habitat health. Any assessment of future forest conditions in the NRS-FIA region will benefit from information on the ability to regenerate native forests to replace today's aging resource.

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