FY 2008 –
FY 2013

Monitoring and Evaluation Report

Allegheny National Forest

USDA – Forest Service | October 2014

Approval and Declaration of Intent

This report documents and evaluates the results of monitoring the implementation of the Allegheny National Forest (ANF) 2007 Land and Resource Management Plan (Forest Plan) for Fiscal Year (FY) 2008 through FY 2013.

The Chief of the Forest Service affirmed the 2007 Forest Plan in February 2008, but suspended application of the new design criteria to oil and gas development (OGD) and issued instructions to remedy NEPA deficiencies. The Chief's Appeal Decision is available online at: http://www.fs.fed.us/emc/applit/includes/woappdec/080201_allegheny_decision.pdf

On January 16, 2009, Regional Forester Kent Connaughton directed Forest Supervisor Leanne Marten to conduct a Supplemental Environmental Impact Statement (SEIS) to the Forest Plan to fulfill the Chief's instructions. Pursuant to this direction, a Notice of Intent to conduct an SEIS was published in the Federal Register on February 27, 2009. A decision was expected in December 2009, but was not made due to litigation, and the status of the SEIS was changed from "on hold" to "cancelled" in May 2014. Similarly, a decision in the related and concurrent Transition Environmental Impact Statement (TEIS) was not made and its status was also changed from "on hold" to "cancelled" in May 2014. In compliance with the Chief's instructions, Notices to Proceed associated with outstanding and reserved mineral development are being evaluated under the 1986 Forest Plan standards and guidelines.

Legal cases specific to severed mineral estate development on the ANF have been decided since the 2007 Forest Plan was affirmed with instructions. In context of these cases, the Third Circuit Court of Appeals provided, among other things, that the Forest Service "does not have the broad authority it claims over private mineral rights owners access to surface lands. […] Although the Service is entitled to notice from owners of these mineral rights prior to surface access, and may request and negotiate accommodation of its state-law right to due regard, its approval is not required for surface access." Minard Run Oil Co. v. U.S. Forest Service, 670 F.3d 236, 254 (3rd Cir. 2011).

I have reviewed and approve the FY 2008-2013 Monitoring and Evaluation Report for the ANF. This report meets the intent of the monitoring program contained within the Forest Plan. The ANF has made progress toward meeting Forest Plan goals and objectives and moving toward desired conditions, and I intend to consider the recommendations made by the interdisciplinary team that compiled the report. Furthermore, evaluation of information for all monitoring elements indicates the ANF should change the 2007 Forest Plan in a manner that is consistent with the legal cases that have been decided since the Plan was affirmed with instructions.

/s/ Robert Lueckel — 10/7/2014

ROBERT LUECKEL — Date

Acting Forest Supervisor

Table of Contents

List of Tables

List of Figures

Introduction

This report documents and evaluates the results of monitoring the implementation of the Allegheny National Forest (ANF) 2007 Land and Resource Management Plan (Forest Plan) for Fiscal Year (FY) 2008 through FY 2013.

Monitoring and evaluation are separate, sequential activities required by the National Forest Management Act (NFMA). Monitoring is the collection of data by observation or measurement. Evaluation is the analysis and interpretation of monitoring data. The purpose of monitoring and evaluation is to determine whether or not Forest Plan implementation activities comply with Forest Plan direction, if the application of Forest Plan standards and guidelines is meeting Forest Plan goals and objectives, and how effective implementation has proved to be in moving the ANF toward Forest Plan desired conditions. The results of monitoring and evaluation can verify implementation activities or can ultimately lead to changes in Forest Plan management direction or Forest Plan components.

The monitoring and evaluation requirements for the Forest Plan can be grouped into the following three categories:

- *Minimum Legally Required Monitoring Items* – as were defined in the NFMA in the [now superseded] 1982 planning regulations (36 CFR 219).

- *Achievement of Forest Plan Objectives* – pertaining to the level of accomplishment of objectives contained in Part 2 – Strategy of the Forest Plan.

- *Strategic Monitoring Information* – these are strategic in nature to gain additional information.

The sections that follow contain the monitoring and evaluation results of all items listed for annual, 2-year, 3-year, or 5-year evaluation in Table 13 (Minimum Legally Required Monitoring Items), Table 14 (Achievement of Forest Plan Objectives), and Table 15 (Strategic Monitoring Information) of the Forest Plan (pp. 39-51). The items are organized as they appear in the Forest Plan to allow tracking and comparison by table number and resource area. Each item lists the **monitoring question**, **protocol, results, conclusions,** and **recommendations**.

Minimum Legally Required Monitoring Items

Stocking within five years of regeneration harvest

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Lands are adequately restocked within five years of regeneration harvest (36 CFR 219.12(k)5(i)) and (36 CFR 219.27 (c)(3))	Have lands been adequately restocked within five years of regeneration harvest?	Annual	Annual	A[1]

[1] A class value of A in the following tables under the column Precision/Reliability employs methods appropriate for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy, and precision.

Protocol – Stocking surveys were completed on the ground in each regeneration harvest area using ANF and the UDSA-Forest Service Northern Research Station (NRS) stocking survey guidelines (USDA-FS 2007a, p. 69; Appendix A p. A-2). Even-aged regenerated stands on the ANF are considered adequately restocked when at least 70% of sampled plots are stocked with acceptable seedlings at least three years old (USDA-FS 2009). Stands that are being regenerated using single tree selection must have at least 30% of sampled plots stocked with acceptable seedlings at least three years old (USDA-FS 2009). A Forest Plan reforestation standard (USDA-FS 2007a, p. 69) calls for stocking surveys in all regeneration harvests to monitor tree seedling development and to determine the need for additional reforestation treatments.

Stocking surveys were conducted during the 2008-2013 summer growing seasons when species and health of the vegetation were easiest to identify. Stocking surveys were conducted by systematically sampling seedling regeneration on sample plots, using direction provided in the ANF Seedling Stocking Examination, Evaluation and Certification handbook (USDA-FS 2009). Personnel summarized stocking survey results for each regenerated stand, by type of harvest activity and year the harvest cut occurred. Tree seedling stocking is monitored in all regeneration harvests on the ANF until they are considered fully stocked and acceptable composition is achieved.

Results

Scheduled green harvests

Even-aged (single-age) harvests – Reforestation success within five years of green, even-aged (single-age) regeneration harvests (considering harvests completed between FY 2003 and FY 2008) ranges from 91.0% (FY 2003 harvests; Table 1) to 95.6% (FY 2005 and FY 2008 harvests).

Even-aged (two-age) harvests – Reforestation success for two-aged regeneration harvests ranges from 44.8% (FY 2007 green harvest) to 100% (FY 2003, FY 2005 and FY 2006 green harvests). These percentages are lower than those associated with even-aged (single-age) harvests. When areas that are nearly fully stocked and considered probable successes are included, reforestation success for two-aged regeneration harvests is 100% for both green and mortality salvage treatments (see footnote 2 to Table 1). A "probable success" indicates that seedling stocking is

present on over 50% of sampled plots in even-aged regeneration harvests, and that the stand has a high likelihood of successful restocking based on sampled seedling data. Stands in this category are monitored until they are considered fully stocked and acceptable species composition is achieved.

Uneven-aged harvests – Seedling success rate for green uneven-aged treatments was lower (84.3% weighted average) than even-aged (single-aged) treatments. Most of these treatments occurred during times of high deer populations and applied pre-2007 Forest Plan design criteria for uneven-aged regeneration methods. Additionally, most of the treatments evaluated here are single tree selection harvests that were only successful in regenerating black birch, with very little seedling establishment by other species.

Group selection harvests, as recommended in 2007 Forest Plan design criteria, would create more suitable conditions for a greater diversity of tree seedlings to become established in uneven-aged harvests, thus increasing success rates for stand restocking with using uneven-aged regeneration methods. Post-2007 uneven-aged treatments are implemented using updated guidelines contained in the 2007 Forest Plan, which were formulated to improve the success of uneven-aged treatments as a stand regeneration method to sustain a diversity of tree species. These treatments will typically utilize a group selection uneven-aged regeneration method, very few of which have been implemented so far, and are thus not reflected in this report.

Table 1. Percent of acres stocked within five years of regeneration harvest cut

Fiscal Year Cut	5th-Year Survey Fiscal Year	Even-aged Prescription				Uneven-aged Prescription	
		Green		Mortality Salvage		Green	Mortality Salvage
		Final Harvest	Two-age	Final Harvest	Two-age	All	All
2003	**2008**	91.0%	100.0%	100.0%	-	-	-
2004	**2009**	94.2 %	-	100.0%	0.0%	100.0%	-
2005	**2010**	95.6%	100.0%	68.7%	-	-	-
2006	**2011**	92.2%	100.0%	38.9%	-	45.9%	-
[1]2007	**2012**	91.3%	44.8%	80.1%	-	100.0%	97.2%
2008	**2013**	95.6%	51.2%	68.0%	-	100.0%	35.3%
Total Cut Acres 2003-2008		4,032	260	543	16	324	208
Weighted Average 5th-Year Restocking (Percent)		93.5%	77.7%	74.8%	0%	84.3%	56.7%
Weighted Average 5th-Year Restocking with Probable Success Included (Percent)		98.5%	100.0%	88.2%	100.0%[2]	93.8%	78.8%

[1] Drought Year - when Palmer Drought Severity Index was less than -2 (-2 = moderate drought) for part of the growing season.
[2] One salvage two-aged regeneration harvest totaling 16 acres, which was implemented in FY 2004, had 55% seedling stocking in 2009 and is considered a "probable success" per ANF seedling stocking handbook direction (USDA-FS 2009).

Mortality salvage harvests

Mortality and blowdown regeneration harvests reflect wider yearly fluctuations in five-year success rates, most likely because seedlings were not in place before the catastrophic events occurred.

> Even-aged (single-aged harvests) – Restocking success in even-aged (single-aged) salvage harvests ranges from 38.9% (FY 2006 harvest) to 100% (FY 2003 and FY 2004 harvests), with a weighted average of 74.8% for this time frame (compared with 93.5% weighted average for similar green harvests).
>
> Uneven-aged harvests – Uneven-aged salvage harvests occurred in two years during this time frame and ranged between 35.3% and 97.2%, an indication of low and variable seedling abundance when catastrophic events occurred.
>
> The highest success rate for salvage regeneration harvests (74.8% weighted average) is for even-aged (single-aged) harvests. In all cases, reforestation success rates are fairly good considering these harvests are a response to a natural catastrophic event. Significantly fewer acres of salvage harvest occur than green harvest; the FY 2003-2008 salvage harvest program represented approximately 14% of the green harvest program.

Conclusions – Fifth-year reforestation success is best in scheduled green harvests. Of the categories of regeneration harvest listed, scheduled green even-aged (single-aged) final harvests had the greatest success rates with a weighted average regeneration success rate of 93.5% between FY 2003 and FY 2008. When regenerated areas that are nearly fully restocked and considered probable successes are included, the weighted average is 98.5%.

Uneven-aged harvests continue to have poor fifth-year reforestation success; however, as mentioned above, these results reflect uneven-aged harvests implemented using 1986 Forest Plan design criteria, rather than the newer criteria in the 2007 Forest Plan that we anticipate will yield greater success with uneven-aged regeneration methods.

Weighted averages for both green and salvage regeneration harvests indicate adequate restocking is being achieved within five years of regeneration harvest the vast majority of the time. Those that do not achieve restocking objectives within five years of regeneration harvest will have additional reforestation treatments prescribed, including supplemental planting in some cases, and monitored until they are considered fully stocked.

Recommendations – No changes are recommended at this time. Continue to monitor tree seedling development success and the need for additional reforestation treatments to assure timely and adequate tree seedling stocking in regeneration harvests.

Since uneven-aged treatment success rates are less than desired, continue to implement uneven-aged treatments through an adaptive management approach, taking into account the new direction noted in the Forest Plan (pp. 64-66, 68-69, A-2, A-4 – A-19, A-23 – A-28). Effective evaluation of Forest Plan uneven-aged management guidelines could take up to fifteen years to provide enough time for first entry harvest, follow-up reforestation treatments, development of tree seedlings, and implementation group selection harvest (recommended method in most cases).

Maximum opening size from even-aged management

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maximum opening size from even-aged management and the need for change (36 CFR 219.12(k)5(iii)) and (36 CFR 219.27 (d)(2))	What is the maximum size opening from even-aged management? Is there a need to change the standard?	Annual	5 years	A/B[1]

[1] A class value of B in the following tables under the column Precision/Reliability employs methods based on project records, personal communications, ocular estimates, informal visitor surveys, and similar types of assessments. Reliability, accuracy, and precision are lower than Class A methods, but the methods still provide valuable information.

Protocol – A temporary opening can be created through a final harvest silvicultural treatment and is intended to be re-occupied by young trees. Temporary openings are dominated by trees and saplings less than 15 feet tall that, with time, will grow into a mature forest. Vegetation harvests sold for even-aged regeneration harvests were compiled from vegetation databases, including the Timber Information Manager (TIM) and the Forest Service Activity Tracking System (FACTS) databases. Maps were reviewed for final harvest areas that were sold between FY 2008 and FY 2013 to review adjacent shelterwood removal, clearcut, overstory removal, or two-aged harvest prescriptions to determine the maximum and minimum size of temporary openings by Management Area (MA).

Results – Table 2 displays the minimum, maximum, and average size of areas sold for final harvest, which will result in temporary openings.

Table 2. Size in acres of final harvests by Management Area (FY 2008-2013)

Management Area	Minimum Size	Maximum Size – Scheduled Green Harvests	Maximum Size - Mortality Salvage Harvests	Average Size	Forest Plan Maximum Size specified for Management Area
2.2	4	30	24	17.9	20*
3.0	2	40	50	18.5	40
6.1	6	15	19	12.6	40
7.2	25	25	n/a	25.0	n/a
8.6	7	16	n/a	10.3	40

*Note: Forest Plan guidelines for MA 2.2 specify that oak and white pine forest types may be regenerated with even-aged methods on areas up to 20 acres. An acreage limit for other forest types is not specified, though even-aged regeneration methods for shade-intolerant forest types are permitted.

Conclusions – The size of temporary openings created through scheduled green harvests cannot exceed 40 acres, as specified in the Forest Plan (p. 68 and 111). Regional Forester approval is required to exceed these scheduled green temporary opening sizes. As can be seen from Table 2, the size of green final harvests in timber sales conformed to Forest Plan MA direction.

MA 2.2 guidelines provide additional direction that temporary opening sizes in oak, white pine, and aspen forest types should be less than 20 acres. An acreage limit for other forest types is not specified, though even-aged regeneration methods for shade-intolerant forest types are permitted. Five final harvests in MA 2.2 resulted in temporary openings that exceed 20 acres, most by less than 4 acres. All of these final harvests were the result of stand regeneration prescriptions initiated prior to 2007 when the MA was changed to 2.2. All of these areas had received shelterwood seed cuts that were consistent with 1986 Forest Plan direction, and were initially prescribed for single-aged shelterwood removal final harvests. To maintain greater consistency with MA 2.2 vegetation desired conditions, each of these even-aged prescriptions was changed to a two-aged final harvest, which retains more legacy trees and structural diversity within resulting temporary openings.

The shelterwood removal sold in MA 7.2 was a continuation and final harvest of an oak stand that is part of a research study with NRS. This final harvest is consistent with Forest Plan direction for MA 7.2 (USDA-FS 2007a, p. 139).

Unscheduled salvage treatments occur in response to catastrophic forest damage from wind, insects, or disease. Salvage regeneration treatments are designed to regenerate poorly stocked, heavily damaged or declining stands to young, well-stocked forest stands. In these cases, the size of the damaged area was determined by the disturbance event which, in turn, determined the size of the subsequent silvicultural treatment. Salvage temporary openings created in response to tree mortality and decline are not constrained in size (USDA-FS 2007a, p. 68). As can be seen in the table, the maximum size of salvage harvests sold in response to damaging agents was 50 acres, and occurred in MA 3.0.

Recommendations – Continue monitoring the size of temporary openings created through shelterwood removals, clearcuts, or two-aged harvests to ensure Forest Plan standards and guidelines are met.

Destructive insects and diseases

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Ensure destructive insects and diseases do not increase to potentially damaging levels following management activities (36 CFR 219.12(k)5(iv))	Have destructive insects and diseases increased to potentially damaging levels after management activities?	Annual	Annual	B

Protocol – The following specific types of forest health monitoring occurred during the fiscal years between 2008 and 2013. Data collection adhered to standard agency protocol or Forest Health Monitoring (FHM)/Forest Inventory and Analysis (FIA) protocol. All collected information was stored in agency databases or in field notes. Monitoring activities included:

- Informal observations made by Forest field-going personnel;
- FHM/FIA forested land plot data collection from FY 1998 to FY 2013;
- Summer aerial detection surveys by USDA-Forest Service Northeastern Area, State and Private Forestry Forest Health Protection (FHP), Pennsylvania Department of Conservation and Natural Resources – Bureau of Forestry (PADCNR-BOF), and Forest personnel;
- Field surveys conducted by FHP entomologists and pathologists, and Forest personnel; and

- Observations by PADCNR-BOF and Pennsylvania Department of Agriculture (PDA) and USDA-Animal and Plant Health Inspection Service (APHIS) personnel.

Additional information on exotic forest pest species and their status nationwide can be found at www.aphis.usda.gov. The USDA-Forest Service Northeastern Area website (www.na.fs.fed.us) provides additional information regarding the current status of both native and exotic forest pests in the Northeastern United States.

Aerial surveys are conducted with two observers looking for signs of tree canopy discoloration, defoliation, damage, or death while flying evenly spaced flight lines in a fixed-wing aircraft, looping back until the entire ANF is covered. Observers use a digital aerial sketch mapping (DASM) system to identify, sketch, and rate the severity of any areas noted to contain tree discoloration, defoliation, or tree mortality, and attempts are made to identify their causes. The DASM system is linked to a Global Positioning System (GPS) to map the exact location of the plane and flight lines, creating an accurate sketch map produced in real time. Subsequent ground-truthing of aerially-mapped tree decline, damage, or mortality occurs to further assess the extent and cause of the damage.

In FY 2011, in addition to aerial surveillance surveys, the ANF began employing moderate resolution imaging spectroradiometer (MODIS) data to assess disturbance events. The data are acquired from the Forest Service Health Technology Enterprise Team's Forest Disturbance Mapper (FDM; http://foresthealth.fs.usda.gov/portal/Flex/FDM?dL=0).

The MODIS and normalized difference vegetation index (NDVI) data have a resolution of 240 m² (14.2-acre pixel) and are created from a 16-day interval composite. The FDM data utilized by the ANF are 3-Year Real Time Forest Disturbance (RTFD) data. The three-year RTFD dataset is a digital change detection product that compares the current RTFD greenness (derived from NDVI) to a three-year baseline of greenness. The RTFD is designed to detect short-term defoliation forest disturbance in deciduous forests.

Results

Aerial surveillance results

FY 2008 – An aerial survey flight conducted in July 2008 detected a total of 51,711 acres with visible damage within the proclamation boundary of the ANF (Figure 1). Ground-truthing surveys revealed that a number of different agents and defoliators were active on a variety of hardwoods and conifers. The most commonly reported agents on hardwoods were beech bark disease (BBD) and leaf anthracnose. The most common conifer damage appeared confined to pine plantations and was due to various pine beetles.

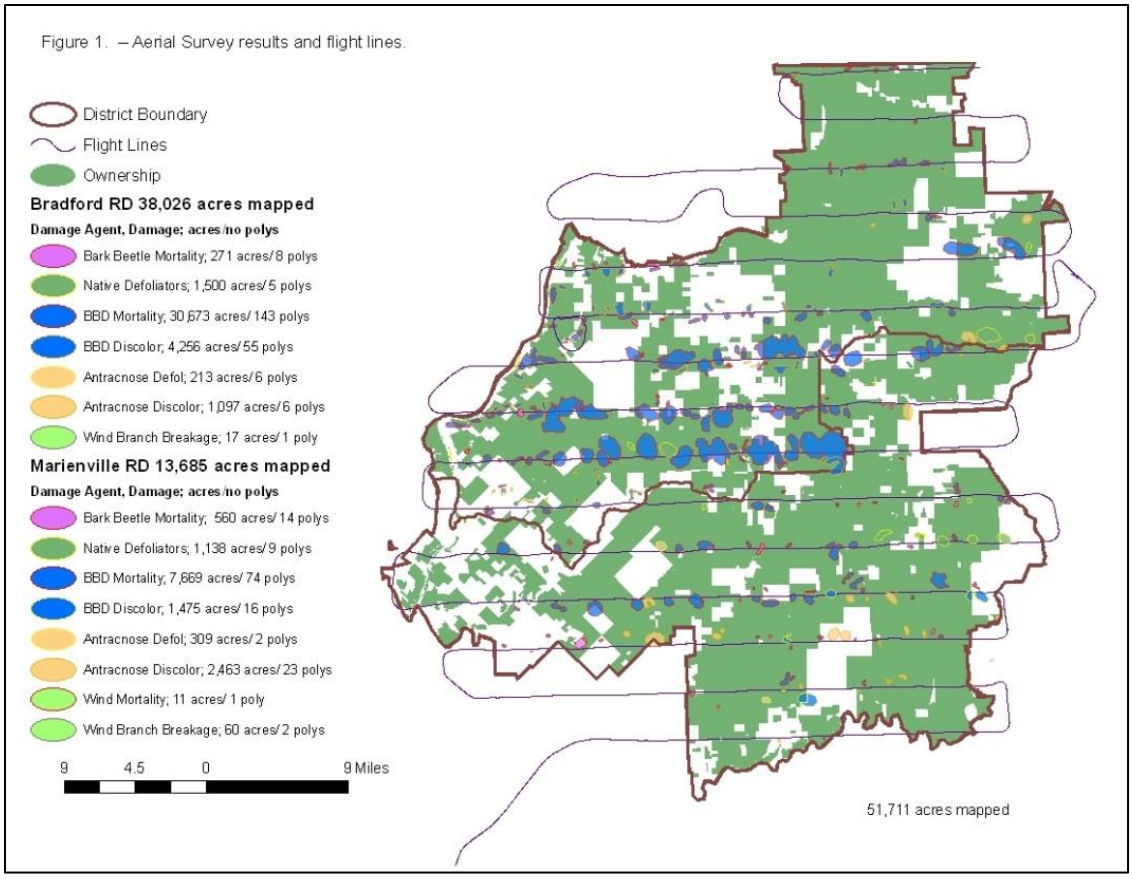

Figure 1. Map of FY 2008 Forest Health Monitoring aerial survey results and flight lines

FY 2009 – The 2009 aerial surveillance flight detected 18,402 acres of visible damage within the proclamation boundary of the ANF (Figure 2). This was a significant decline from the 51,711 acres of damage observed during the 2008 aerial surveillance flight. This reduction was due primarily to a decrease in observed damage caused by BBD in 2009. The decline and mortality of trees caused by BBD was still quite evident in the Tionesta Scenic and Research Natural Areas in 2009, as seen by the larger area of BBD damage mapped in the eastern central portion of the Forest. Ground-truthing surveys revealed that, in reality, a number of different agents and defoliators were active on a variety of hardwoods and conifers. The most commonly reported being BBD and leaf anthracnose on hardwoods and various pine beetles on conifers confined to pine plantations.

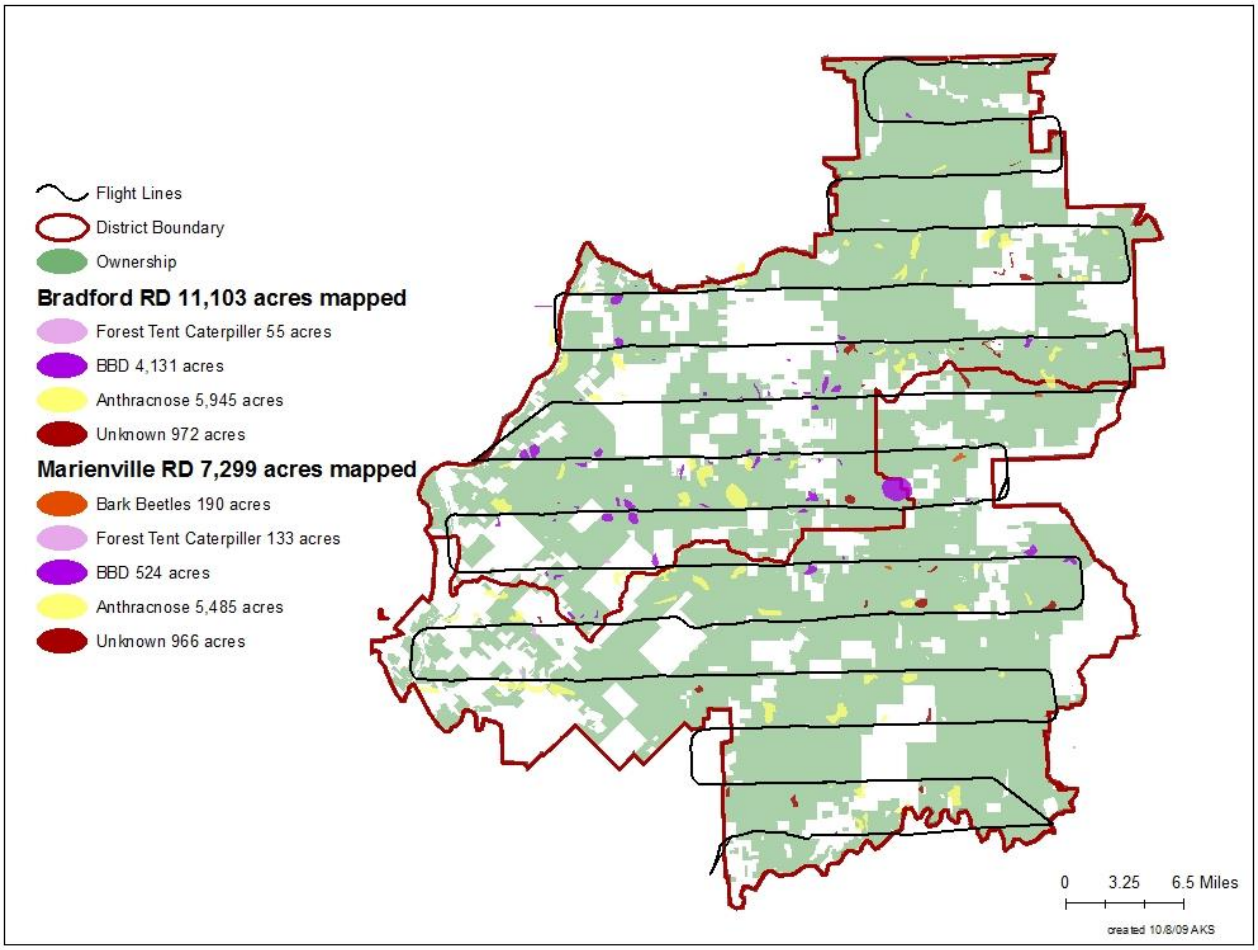

Figure 2. Map of FY 2009 Forest Health Monitoring aerial survey results and flight lines

FY 2010 – The July 2010 aerial surveillance flight detected another reduction in the amount of visible damage within the proclamation boundary of the ANF. A total of 13,955 acres of visible tree visible damage was mapped, down from the 18,402 acres observed during the 2009 flight (Figure 3). As in 2009, this reduction was due primarily to less observed damage from BBD. As in the previous year, ground-truthing surveys also revealed that a number of different agents and defoliators were active on a variety of hardwoods and conifers. Frost and forest tent caterpillars (FTC) were the most common agents reported on hardwoods, and various pine beetles caused the most frequently observed damage on conifers in pine plantations.

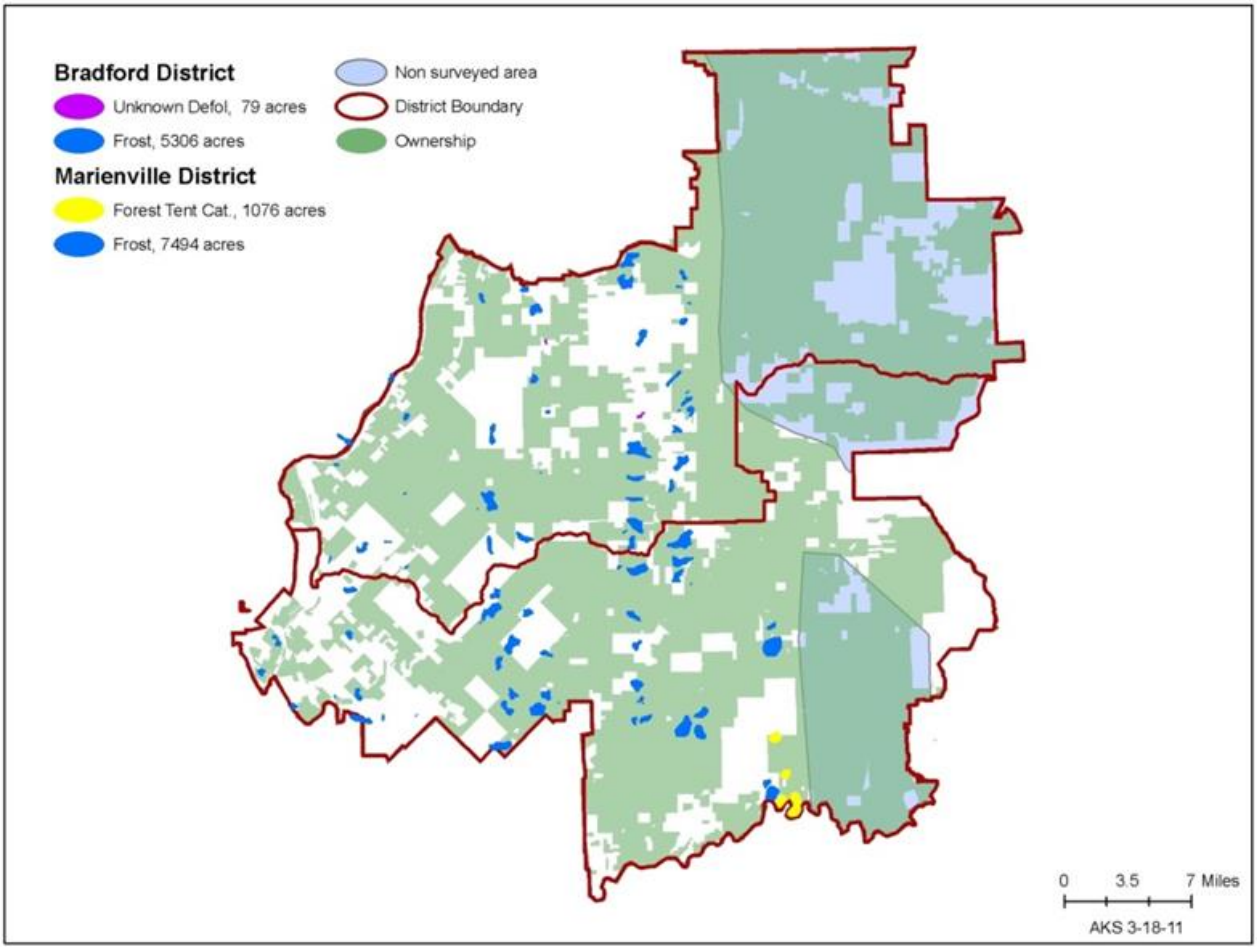

Figure 3. Map of FY 2010 Forest Health Monitoring aerial survey results

FY 2011 – The July 2011 aerial surveillance flight detected a noticeably decreased amount of visible damage within the proclamation boundary of the ANF (Figure 4), with a total of 4,348 acres, a decline from 13,955 acres observed during the 2010 flight. This reduction is primarily due to less observed damage from frost and FTC damage. Ground-truthing surveys revealed that a number of different agents and defoliators were active on a variety of hardwoods and conifers.

The most commonly reported hardwood damage agents were caused by unknown defoliators. Toward the end of the growing season, based on field reports and the phone calls received by the ANF, the defoliation was likely a result of complex of native defoliators, of which the fall webworm was the most commonly reported. Native defoliation was observed on both Ranger Districts, with 1,994 acres observed on the Bradford Ranger District and 382 acres on the Marienville Ranger District. The FTC was active in 2011, defoliating 1,110 acres across the Forest. In addition, 962 acres of oak and maple anthracnose were observed on the Marienville Ranger District.

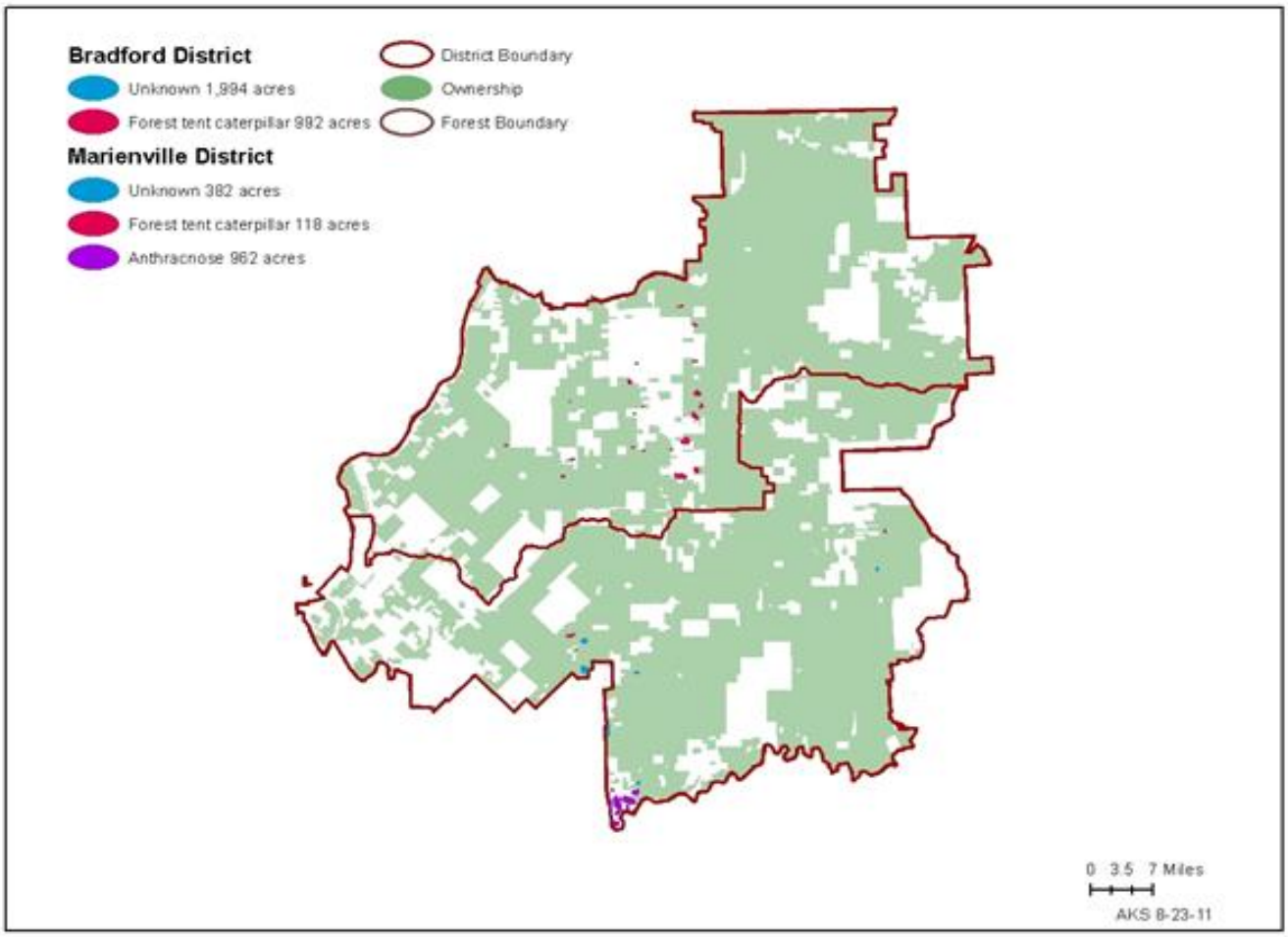

Figure 4. Map of FY 2011 Forest Health Monitoring aerial survey results

FY 2012 – The July 2012 aerial surveillance flight identified 1,574 acres of visible damage within the Forest's proclamation boundary, a decline from the previous year that observed 4,348 acres of damage (Figure 5). The reduction during this year was primarily due to less observed damage from anthracnose and native defoliator damage. Drought stress, mortality and some gypsy moth activity were also reported on both Ranger Districts.

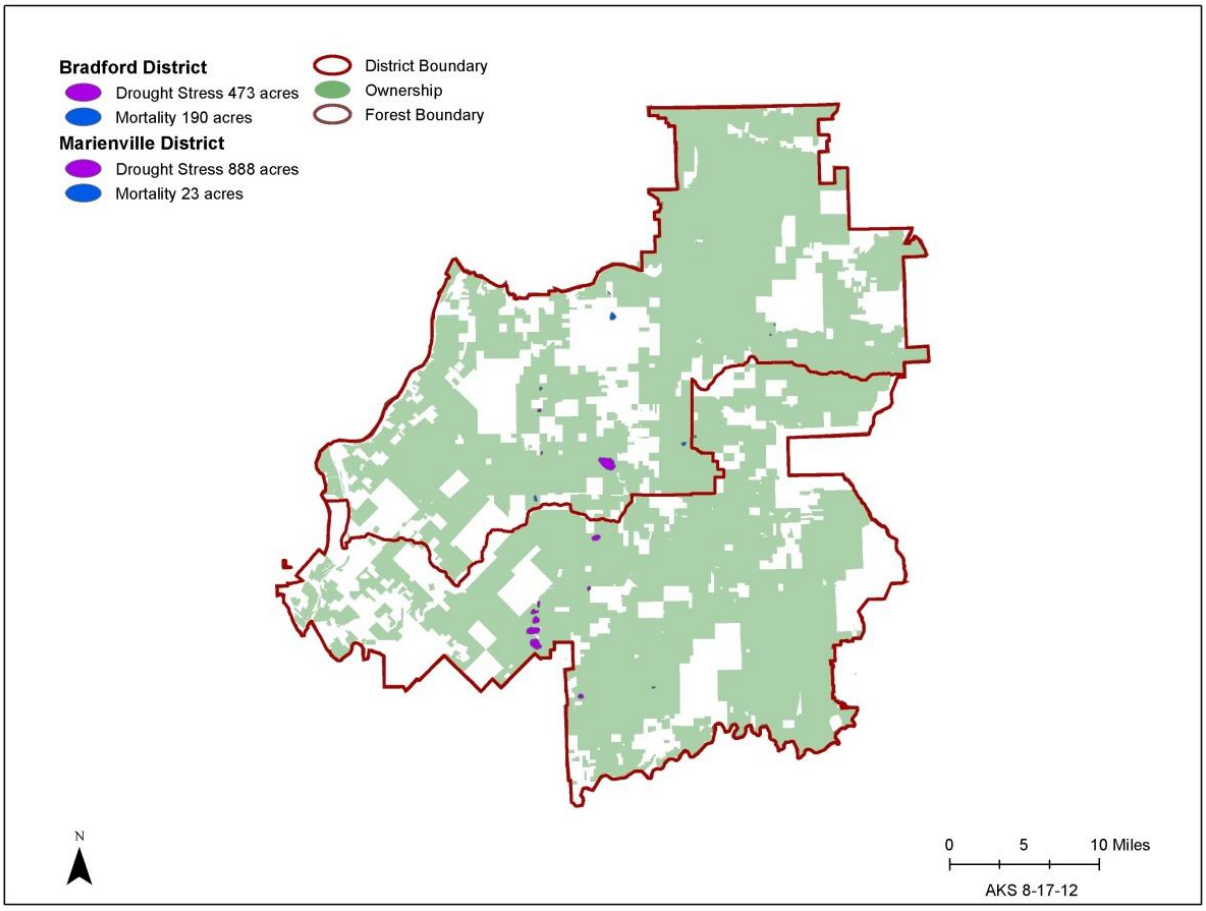

Figure 5. Map of FY 2012 Forest Health Monitoring aerial survey results

FY 2013 – Observations made during the July 2013 aerial surveillance flight identified conditions that departed considerably from previous year observations. A total of 77,351 acres of visible damage was mapped during the aerial surveillance flight within the Forest's proclamation boundary (Figure 6, State data). Monitoring of the MODIS satellite data showed that peak disturbance occurred between June 10 and 25. During this time, approximately 189,994 acres of detectable departure from the 3-year historical baseline was identified (Figure 6, FDM data). ANF staff members conducting field work reported high levels of gypsy moth defoliation across the Forest, with complete defoliation identified in areas around the Allegheny Reservoir and Kinzua Dam. The majority of defoliated areas fell within areas that are not actively managed on the ANF and are dominated by oak species. Despite the high level of defoliation, by mid- to late- summer an almost complete recovery of the canopies was observed in most areas.

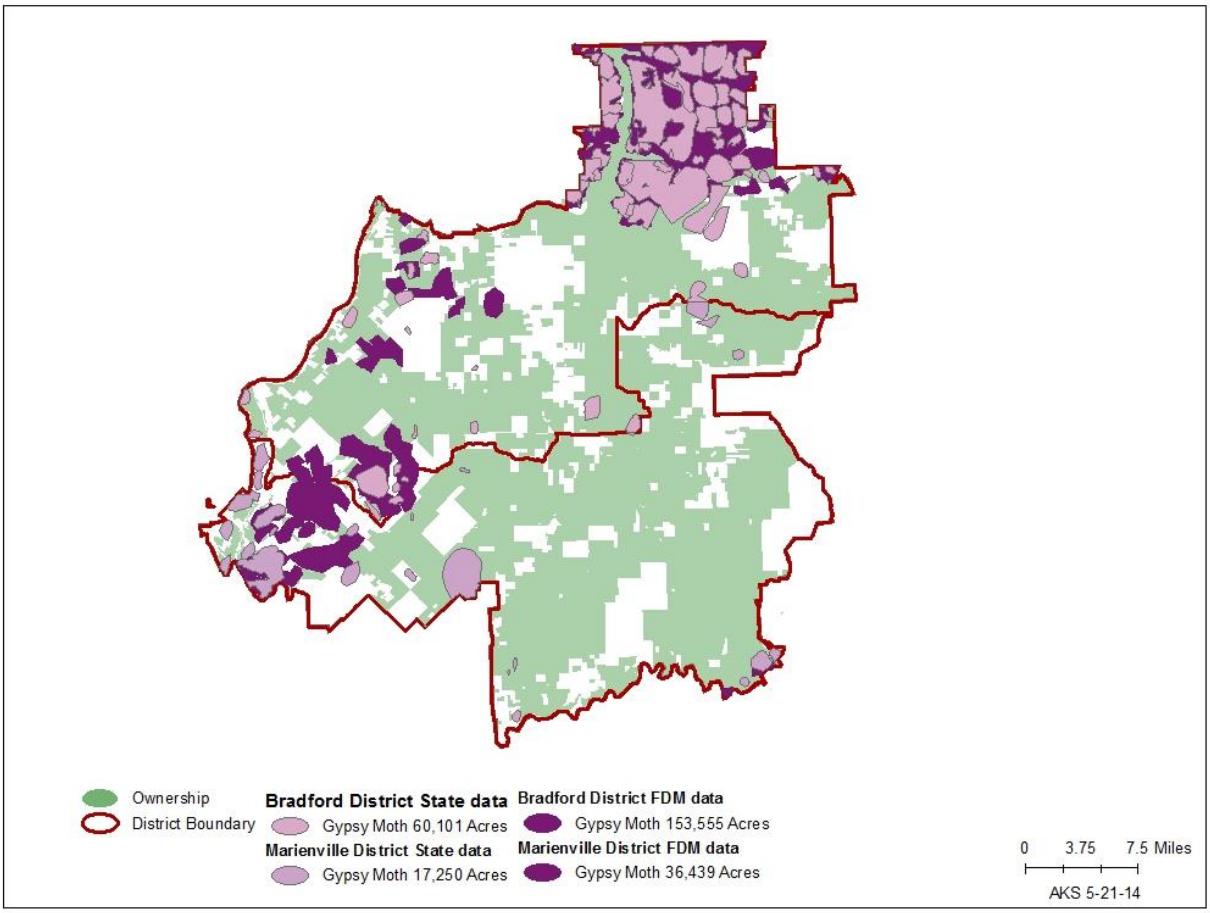

Figure 6. Map of FY 2013 Forest Health Monitoring aerial survey results and Forest Disturbance Mapper results

Native insects

The following section provides an update to previous forest-wide discussion of forest health that was published in the Forest Plan Final Environmental Impact Statement (FEIS; USDA-FS 2007b, pp. 3-78 to 3-105) and in the FY 2008 Monitoring and Evaluation Report (USDA-FS 2008a). Substantial detailed background information, organized by individually named insect, disease, or category of threat to forest health, can be found in the referenced documents. The following discussion is by exception; topics discussed here will include only those where there is new information to report. The information reported below applies to the Forest, both to areas that have had management activity as well as to those areas that have had little or no activity, unless otherwise noted. If references pertain to areas outside of the Forest, it will be noted as such.

Native insects and diseases (cherry scallop shell moth, FTC, pine budworm, oak leaf tier, elm spanworm, fall webworm, anthracnose and bark and ambrosial beetles) have caused defoliation, discoloration, dieback and mortality during the past 20 years on the Forest, and throughout Pennsylvania due to overstocking and competition among trees, combined with beetle infestations. Management to reduce stocking and competition would improve overall stand vigor and health in these areas.

Conifer decline and mortality – In FY 2008, 831 acres of conifer mortality was mapped. Most of this mortality was observed in pine plantations and was likely due to overstocking and competition among trees, combined with beetle infestations. In FY 2009, 850 acres of conifer mortality and decline was mapped on the ANF, virtually unchanged from 2008 observations. Most of this mortality was observed in pine plantations and was likely due to overstocking and competition among trees, combined with beetle infestations.

Cherry scallop shell moth (*Hydria prunivorata*) – Cherry scallop shell moth is a mid-season defoliator that predominantly affects black cherry trees. Historically, cherry scallop shell moth has caused substantial defoliation approximately every 10 years (the last substantial defoliation occurred in 1996), indicating the distinct possibility of an outbreak in the near future if historical patterns persist.

Fall webworm (*Hyphantria cunea*) – The fall webworm (FWW) feeds on a wide variety of hosts including: hickory, walnut, maple, elm, and cherry. Damage from the FWW occurs late in the year, and is usually cosmetic. As such, treatment is usually not necessary.

The ANF experienced an outbreak of FWW in the late summer of 2011 and 2012. Black cherry trees were the primary species affected by this outbreak (Figure 7).

Figure 7. Fall webworm defoliation of black cherry

Data from MODIS and the Eastern Forest Environmental Threat Assessment Center (EFETAC) indicated that a total of 22,162 acres were affected by FWW, with 16,268 acres of light, 4,872 of moderate, and 1,022 acres of severe change in the NDVI during August and September 2011 (Figure 8). Because the FWW is a late-season defoliator and outbreaks typically last one to two years, it is not normally considered a forest pest or an agent of high tree mortality. However, trees that experience high defoliation from it are more likely to suffer reduced growth and branch dieback. No FWW control measures were undertaken on the Forest, although the FWW population was not expected to decline in 2012, especially in the newly infested areas. During the 2011 outbreak, it was recognized that it would take several seasons for the population of

FWW's natural predators to increase to a level at which the FWW population could be controlled.

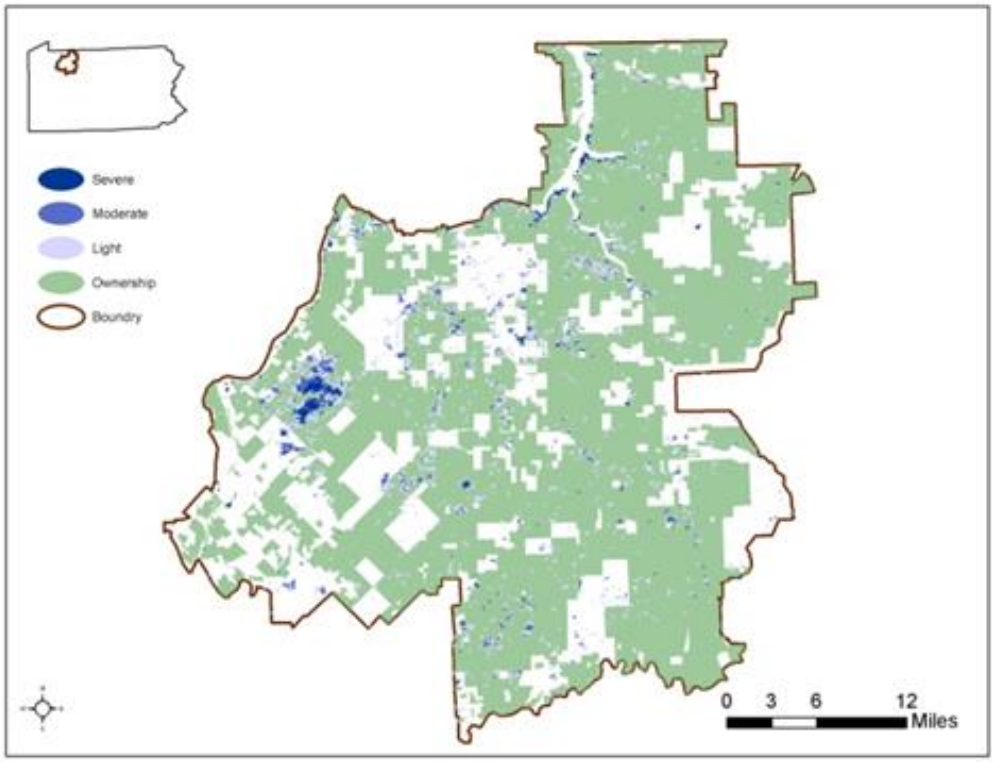

Figure 8. Map illustrating forest disturbance on the ANF as indicated by the Forest Disturbance Mapper change assessment for September 29, 2011

A second year of FWW outbreak was experienced on the ANF in late summer of 2012, and black cherry remained the species that was primarily affected. Data from MODIS and EFETAC indicated that a total of 20,572 acres were affected by FWW in 2012, with 14,942 acres of light, 3,374 of moderate, and 2,256 acres of severe change in the NDVI (Figure 9). As in 2011, no FWW control measures were undertaken on the ANF.

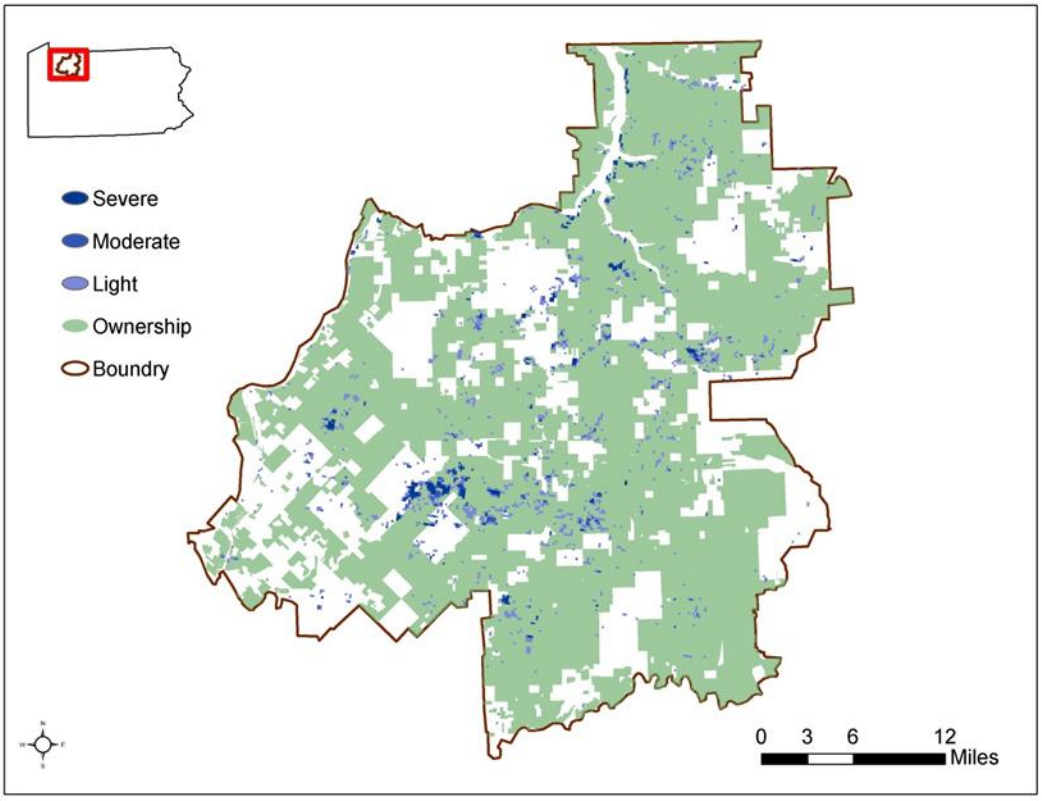

Figure 9. Map illustrating the forest disturbance on the ANF as indicated by the Forest Disturbance Mapper change assessment for September 22, 2012.

No late season FWW defoliation outbreaks were observed in 2013. As a result it was concluded that FWW populations had returned to pre-outbreak levels.

As a consequence of the defoliation of black cherry on the ANF in 2011 and 2012, the ANF initiated an assessment of black cherry crown health to begin in 2014. In the past 10 years, black cherry on parts of the ANF has suffered from crown injury and mortality caused by high wind events in July 2003, July 2004, and more recently in July 2012. Foresters have also reportd sporadic seed production and poor seedling establishment and growth during the last decade. The purpose of this assessment is to evaluate the impact of multiple stressors including fall webworm defoliations and wind storm damage by following the trajectory of black cherry crown health over the next three years using a network of FHM plots on the ANF, and to assess seed production and seedling regeneration on associated plots.

Forest tent caterpillar (*Malacosoma disstria)* – The FTC, also a native insect, primarily attacks sugar maple, oak, poplar and other deciduous hardwoods. FTC populations have caused extensive defoliation throughout Pennsylvania since 2006. Region-wide outbreaks of it have been documented since colonial times and can last from six to 16 years in the northeast. Low winter temperatures and predation by the pupal parasitoid *Sarcophaga aldrichi* and a larval pathogen, *Furia gastopachae*, usually combine to reduce populations.

The FTC reached outbreak levels between 2007 and 2009 in the northern tier counties of Pennsylvania, east of the ANF, in Potter and McKean Counties. In 2009, over 370,000 acres of

Pennsylvania was defoliated, two-thirds of which was characterized by heavy defoliation (PADCNR-BOF 2009).

The FTC again reached outbreak levels 2010 in the north central counties of Pennsylvania, with over 520,000 acres of defoliation being observed in Potter, Tioga, Clinton and Lycoming Counties (PADCNR-BOF 2010). By 2011, FTC populations had declined statewide, though over 25,000 acres with tree mortality in north central counties was attributed to 2007-2010 FTC defoliation (PADCNR-BOF 2011).

The FTC was active on the ANF in 2010 and 2011, with over 1,000 acres of defoliation detected during aerial surveillance flights both years. No FTC damage was detected in 2012 or 2013 on the ANF.

Exotic insects

Gypsy moth (*Lymantria dispar*) – The gypsy moth was introduced into the United States from France in 1869 (USDA-FS 2007b, pp. 3-96 and 3-97), and has been present on the ANF since the early 1980s. Populations have been kept in check in recent years by a nuclear polyhedrosis virus (*Nucleopolyhedrosis* virus) and a fungus (*Entomophaga maimaiga*). The fungus requires high spring humidity and moderate temperatures to germinate and spread and it appears that moist spring conditions favor fungal and viral gypsy moth controls on the ANF.

With the exception of a very small amount of light defoliation in 1999 and 2003, no measurable gypsy moth defoliation was detected on the ANF between 1983 and 2012. While gypsy moth defoliation increased in central and eastern Pennsylvania in 2008 (766,507 acres of moderate to severe tree defoliation; PADCNR-BOF 2008), no defoliation was detected on the ANF. In 2008, gypsy moth defoliation increased in eastern Pennsylvania; however, gypsy moth spray programs initiation in early 2009 in these areas treated 177,688 acres, significantly reducing the defoliation levels during that year.

It was projected that gypsy moth populations would increase in 2013 across the state and in Clarion, Forest, Jefferson, McKean, Potter Tioga and Venango Counties (PADCNR-BOF 2012). During the spring of 2013, the ANF experienced an outbreak of the gypsy moth causing widespread defoliation in June, predominantly around the Allegheny Reservoir. Data from the FDM identified nearly 190,000 acres of detectable change at this time. Field personnel later reported that previously defoliated areas were undergoing widespread re-foliation by mid-July.

Several nearby landowners, including New York Office of Parks, Recreation, and Historic Preservation (Allegany State Park), PADCNR-BOF, and the U.S. Army Corps of Engineers (USACE) treated for gypsy moth in 2013.

In an effort to estimate gypsy moth population densities and to assess the need for treatments in FY 2014, gypsy moth egg mass surveys were conducted in 35 locations, on 190 plots over 7,859 acres across the Forest during the fall of 2013 (Figure 10). Average egg mass densities ranged from 0 (less than 250 egg masses per acre-densities sufficient to predict background or only nuisance levels of gypsy moth defoliation) to 1,020 masses per acre, which indicated that the population had greatly declined over the summer season likely due to viral and fungal infections. In addition, extensive larval mortality was noted in almost all of the surveyed areas, suggesting that natural agents such as viral and fungal infections were effectively controlling the population. Overall, low levels of gypsy moth defoliation are predicted for the ANF in FY 2014, with the

exception of Cornplanter Bay, Hodge Bay, and Hopewell Campground. These locations contained egg mass densities sufficient to predict localized, moderate to heavy defoliation in FY 2014.

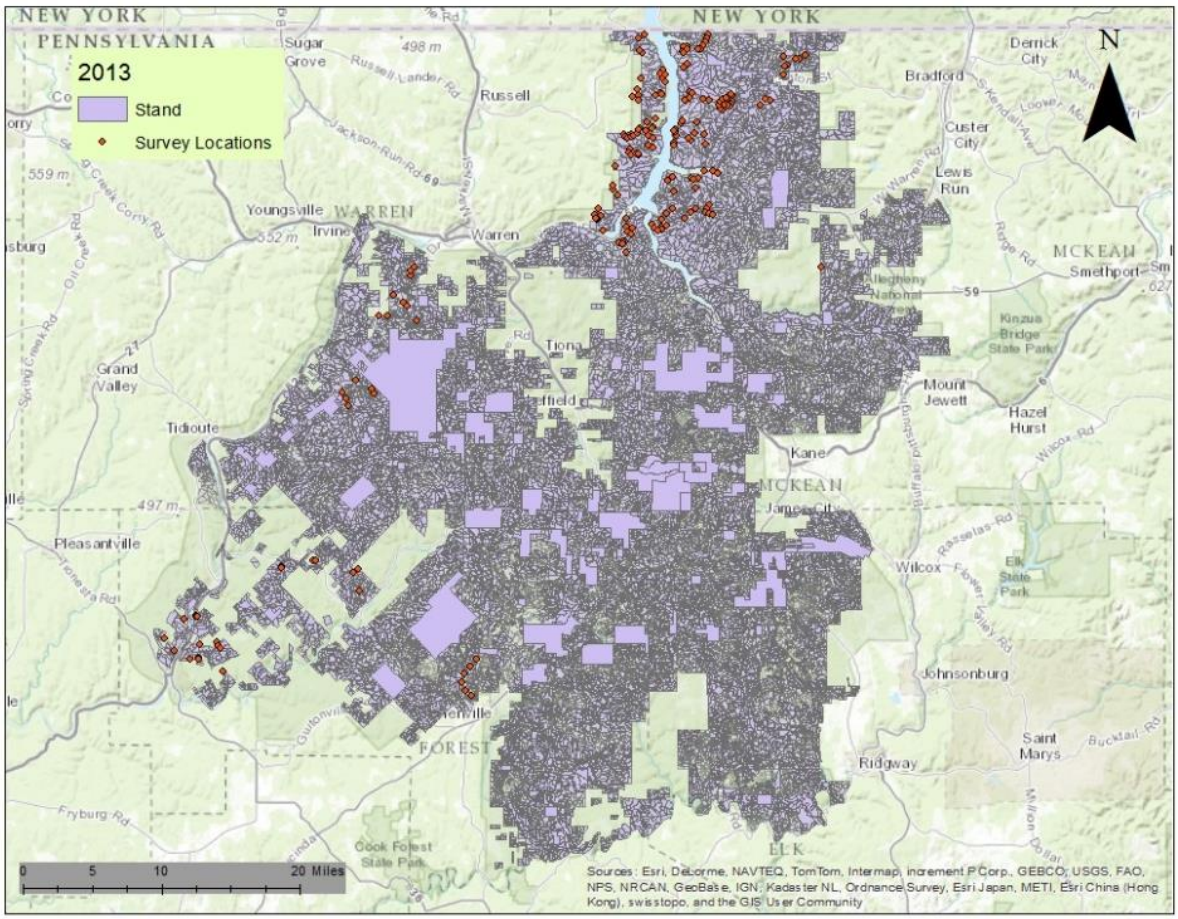

Figure 10. Map of areas surveyed for gypsy moth egg masses on the ANF in the fall of 2013.

Oak species comprise approximately 9% of the ANF's basal area, and are concentrated along major drainages across the Forest. The recurrence of destructive gypsy moth outbreaks throughout the Forest has caused, and has the potential to cause additional mortality of oak species on the ANF. There is likelihood for gypsy moth populations to build up again to a level that will require treatment in the future. Oak decline and oak wilt are other serious threats to the health of oaks on the ANF. The National Insect and Disease Forest Risk Assessment (Krist Jr. et al. 2014; http://www.fs.fed.us/foresthealth/technology/nidrm.shtml) predicts the ANF could lose 18% of the oak basal area over the next 15 years.

Asian longhorned beetle (*Anoplophora glabripennis*) – The Asian longhorned beetle (ALB) is an introduced pest that originated in China. ALB is a wood borer that infests a range of host trees including maples, birches, and elms (Figure 11).

It was first discovered in the United States in 1996 in Brooklyn, NY. Since then, additional populations have been found in New York, New Jersey, Illinois, and Massachusetts, and Ohio

where eradication efforts are ongoing. In August of 2008, the ALB was identified in Worcester, Massachusetts far outside the range of any previously known populations. This population is believed to be eight to 10 years old, and efforts to eradicate it have resulted in the destruction or treatment of nearly 35,000 infested or high risk trees within a 74-square mile quarantine area. In June of 2011, the ALB was discovered in Clermont County, Ohio. Efforts to eradicate it have resulted in the destruction or treatment of nearly 35,000 infested or high risk trees within a 61-square mile quarantine area.

Surveys for ALB have occurred in Pennsylvania since 2005. However, ALB has not yet been detected on the ANF, or in Pennsylvania.

Figure 11. Asian longhorned beetle (from Dean Morewood, Health Canada, Bugwood.org)

Emerald ash borer (*Agrilus planipennis*) – Emerald ash borer (EAB) is an exotic beetle (USDA-FS 2007b, p. 3-104) native to Asia (China, Japan, Korea, Mongolia, and the Russian Far East) that attacks all species of ash trees. EAB is identified by its oblong, metallic green body that is about half an inch long (Figure 12). It is primarily spread by humans through movement of untreated wood infested with EAB (such as firewood) into un-infested areas. Since 2002, it has caused the mortality of an estimated 50 million ash trees. Currently, there are no effective landscape scale treatment options for EAB.

Figure 12. Emerald ash borer (from David Cappaert, Michigan State University, Bugwood.org)

Since its detection in 2002 in Detroit, Michigan, EAB has spread to 21 eastern and Midwestern states, and Ontario, Canada (Figure 13). In 2007, it was detected for the first time in Pennsylvania in Butler and Allegheny Counties. Between 2007 and 2010, the PDA increased EAB survey intensity.

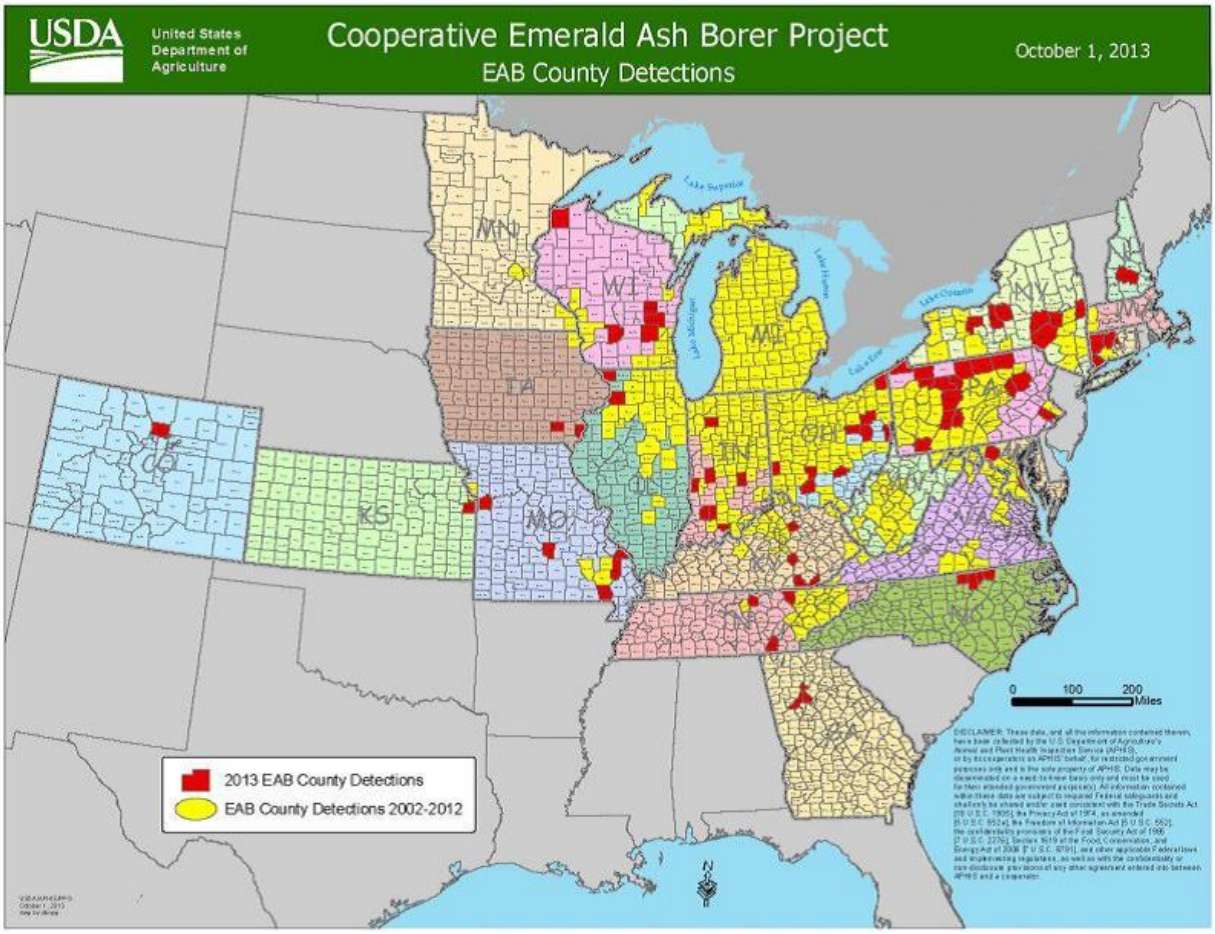

Figure 13. Emerald ash borer distribution (October 2013)

In 2008, two levels of survey were used in Pennsylvania to try and detect EAB. One was a delimiting survey using a 1.5 x 1.5 mile grid (1 trap/grid) in areas within 100 miles of the quarantined counties and the other was a detection survey outside the generally infested counties. Both surveys were used to determine whether additional infestations were present. In total, 8,000 purple prism traps (Figure 14) baited with manuka oil were deployed within the state across 35 counties. Mercer County, Pennsylvania, had the only new population detected by these surveys, and was added to the Pennsylvania EAB Quarantine at that time.

Figure 14. Emerald ash borer prism trap

As part of the state-wide 2008 EAB delimiting survey, 924 prism traps were placed within the ANF proclamation boundary; 594 of these were placed on ANF lands. Additionally, FHP personnel placed prism traps at 11 locations on the ANF, focusing trapping efforts around high use recreation areas with ash trees present. Visual and sweep net surveys were periodically conducted in conjunction with the prism trapping efforts. No EAB detections were made in the immediate ANF area (Warren, Elk, Forest, and McKean Counties).

In 2009, PDA survey crews placed panel traps baited with manuka and phoebe oil on a 1.5 mile grid in 15 western counties, including Warren and Forest Counties. In the remainder of the state, including McKean and Elk Counties, surveys focused on high risk areas such as campgrounds, industrial areas, highways and private lands. No EAB detections were made in the immediate ANF area (Warren, Elk, Forest, and McKean Counties).

Prior to 2013, the closest identified EAB population was detected in 2009 in Randolph, Cattaraugus County New York, approximately 11.5 air miles north of the ANF. In June 2013, EAB was detected near the Clarion River on the ANF. EAB was also detected in Warren and Forest Counties in 2013, on private lands within the ANF proclamation boundary. It is very likely there are other infestations on the ANF. Personnel continue to evaluate ANF ash resources and develop appropriate responses to address overall forest health in these areas.

County by county quarantines on the movement of ash nursery stock, green lumber and any other ash material, including logs, stumps, roots and branches, and all wood chips were implemented by PDA between 2007 and 2010. By the end of 2010, the PDA had imposed quarantines on 42 Pennsylvania counties to slow the spread of EAB. Due to the number of EAB detections in Pennsylvania and adjacent counties in neighboring states, in April of 2011 the internal state quarantine restricting the movement of ash within Pennsylvania was rescinded.

In addition, PDA has quarantined the movement of any firewood of any species into the state of Pennsylvania from any other state since 2007. Ohio, West Virginia and New York also have quarantines on the movement of any firewood of any species into any of these states.

In order to prevent movement of infested firewood to the ANF, a firewood closure order has been in effect since July 2007. Periodic surveys of campers were conducted in 2007 and 2008 to ascertain the origin of firewood brought to the ANF, as well as educate visitors about the importance of not moving firewood. In 2007, the year EAB was discovered in Pennsylvania, 51% of firewood brought to the ANF originated from quarantined counties in Pennsylvania or from out of State. With effective public education, this figure was reduced to 25% in 2008. Surveys indicated that 93% of campers use firewood during their stay. A quick survey conducted in five ANF developed campgrounds on July 6, 2009 revealed:

- Approximately 60% of campers interviewed were familiar with EAB,
- All but one individual were aware of the ANF firewood restriction, and
- Over half of the visitors were from Elk, Forest, McKean or Warren Counties.

The reduction in firewood movement into the ANF is likely due to widespread public education efforts by a number of federal and state agencies (Figure 15). The ANF has developed an EAB communication plan, which is periodically reviewed and updated. State personnel are also increasing their public education and outreach efforts within Pennsylvania.

Figure 15. Firewood alert sign with an EAB survey panel trap in the background

During the summers of 2011 and 2012 the Forest Service TEAMS Enterprise Unit and ANF personnel conducted a survey of prioritized recreation areas and other high value stands on the ANF. The purpose of this project was to: 1) identify stands that are susceptible and vulnerable to

EAB, 2) inventory these stands, and 3) prioritize stands for monitoring and ash management. More than 1,500 acres within and around recreation areas on the ANF were surveyed in this project (Figure 16).

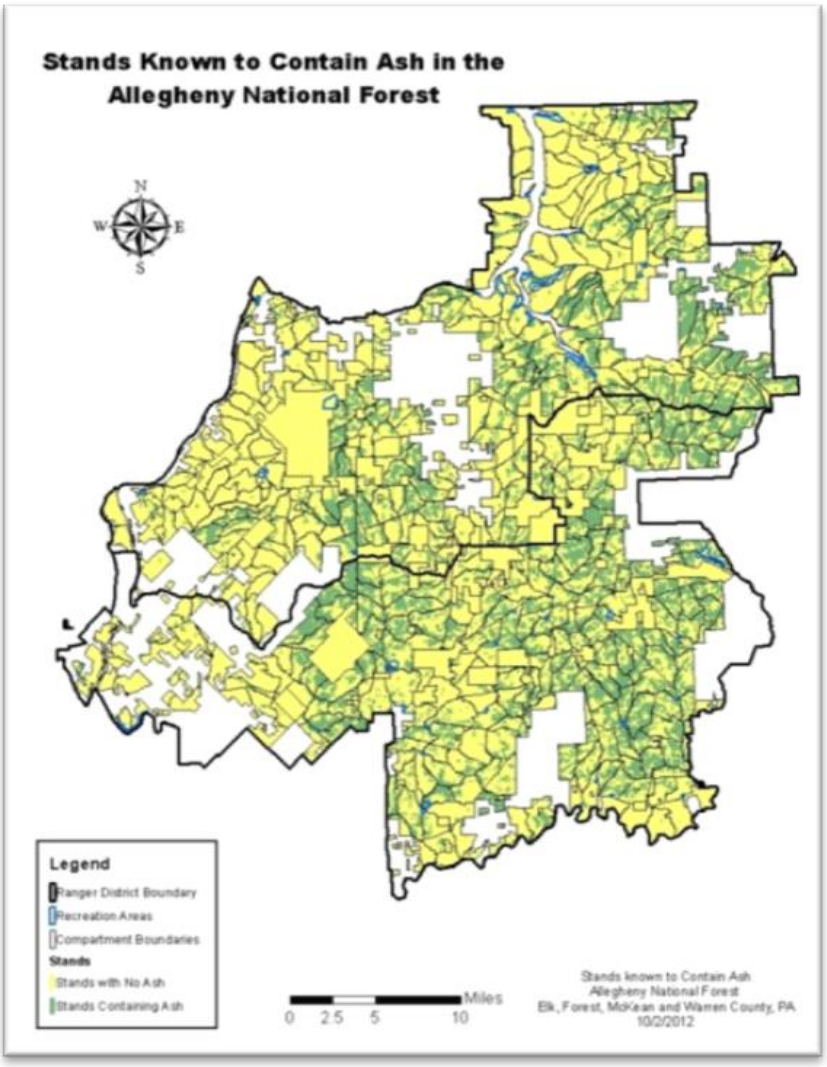

Figure 16. Stands known to contain ash on the ANF

Recreation areas are the most visited areas of the forest but many have never had the trees and vegetation inventoried. With forest health issues such as EAB and hemlock woolly adelgid (HWA) looming it is important to have inventory and tree data regarding these recreational areas because these areas often serve as pathways for introduction by visitors, and trees in these areas are of high aesthetic value.

In an effort to preserve as genetic material (germplasm), ANF personnel collected ash seed in 2011 and 2013 for long term storage at national and regional seed repositories.

Ash species comprise approximately 2.5% of the overall basal area across the ANF. Substantial ash mortality is likely to occur over the next 10 years posing risk to forest health and public

safety. The National Insect and Disease Forest Risk Assessment predicts the ANF could lose 29% of the ash basal area in the next 15 years. In total, near 100% loss of ash basal area is anticipated on the Forest.

Hemlock woolly adelgid (*Adelges tsugae*) – HWA is a non-native insect native to Asia that has the potential to cause substantial hemlock mortality or decline on the ANF in the future (USDA-FS 2007b, pp. 3-103 and 3-104). HWA is a tiny insect that lays its egg sacs, which look like woolly cotton, on the base of hemlock needles, and because of its small size, the identification of its egg sacs are used to determine its presence in an area (Figure 17). HWA are also unique in that populations consist of females that reproduce asexually. Once a HWA infestation occurs, tree mortality normally occurs within four to seven years after infestation, threatening the unique and valuable ecosystem hemlock provides.

Figure 17. Hemlock woolly adelgid egg sacs on hemlock needles (from Connecticut Agricultural Experiment Station)

HWA was first detected in the northeastern United States near Richmond, Virginia in the early 1950s on exotic tree species that a private collector had planted in his arboretum. HWA was first detected in southeastern Pennsylvania in the late 1960s, and as of 2013 is present in 58 of the 67 counties in Pennsylvania, and 18 mid-Atlantic and northeastern states. In 2005, HWA was detected in Elk County, remaining the nearest known infestation to the ANF until 2013, at approximately 25 miles from the Forest boundary. The infested trees were destroyed; however, HWA still persists in the area of the initial detection.

Eastern hemlock comprises approximately 10% of the overall basal area on the ANF, occurs across the entire forest and is largely concentrated in ecologically important areas such as riparian zones. The current and continued spread of HWA is devastating this species of unique ecosystem value in the eastern United States, and high levels of hemlock mortality are anticipated in the coming decades. The National Insect and Disease Forest Risk Assessment

predicts the ANF could lose 31% of the overall eastern hemlock basal area in the next 15 years. The risk model predicts that 26% of eastern hemlock mapped on the ANF will experience a 25% or greater loss of basal area over the next 15 years.

Since 2004, forest personnel have annually surveyed 48 to 104 hemlock stands on the ANF. In 2009, HWA detection surveys were conducted in 70 stands on the ANF. In 2010 efforts to better map hemlock resources were undertaken in an attempt to develop a hemlock risk map for the ANF and better focus survey efforts. In addition, 34 stands were surveyed for HWA. Detection surveys occurred within 35 stands during fiscal year 2011. Thirty-six stands were surveyed for HWA infestations in 2012. No HWA infestations were identified during this time period.

In 2013, two workshops were held on hemlock conservation and HWA identification for the general public and interested volunteers. Private citizens have contributed a considerable effort to hemlock conservation efforts on the Allegheny Plateau, and to date, citizens and citizen groups have adopted 37 areas for HWA monitoring, predominantly on the ANF.

In 2013, an estimated 1,913 acres and 862 hemlocks were surveyed for HWA by volunteers. In 2013, the first HWA infestation was identified on the ANF, along the Clarion River. Later in 2013, additional HWA infestations were identified in the West Fork area of the Tionesta Research Natural Area, along the Allegheny River and at Webbs Ferry boat launch. In the spring of 2013, infestations were also identified in Cook Forest and Clear Creek State Parks.

Between 2004 and 2013, Pennsylvania Department of Conservation and Natural Resources (PADCNR) personnel have treated over 27,000 individual hemlock trees (nearly 400,000 inches of stem diameter) with individual stem pesticide treatments to reduce impacts from HWA in infested trees and slow HWA spread in the Commonwealth (Marasco and Weiss 2013). They have also been working on developing an effective biological control for HWA by releasing three species of predatory beetles: *Laricobius nigrinus*, *Sasajiscymnus tsugae*, and most recently *Laricobiu osakensis*. Between 1999 and 2013, over 193,000 of the predatory beetles have been released in Pennsylvania, including in nearby Cook Forest State Park, in order to help control HWA populations. Additional releases are planned for 2014.

In order to develop an all-lands, landscape-scale strategy for hemlock conservation, the ANF entered into a collaborative partnership with The Nature Conservancy (TNC) and a number of organizations and landowners across the High Allegheny Plateau in 2012. The purpose of this partnership was to identify high value hemlock areas for long-term conservation, regardless of ownership. Over 50 agencies, companies, organizations, institutions and individuals have collaborated on this effort to conserve hemlock trees on the High Allegheny Plateau (Figure 18). Three workshops were held in 2012 and 2013 to identify priority hemlock conservation areas across the plateau. These collaborative efforts have identified sixty areas (approximately 174,000 acres) for conservation on the ANF, with 14 of the 60 areas considered highest priority, including six focal areas totaling approximately 47,000 acres (Figure 19).

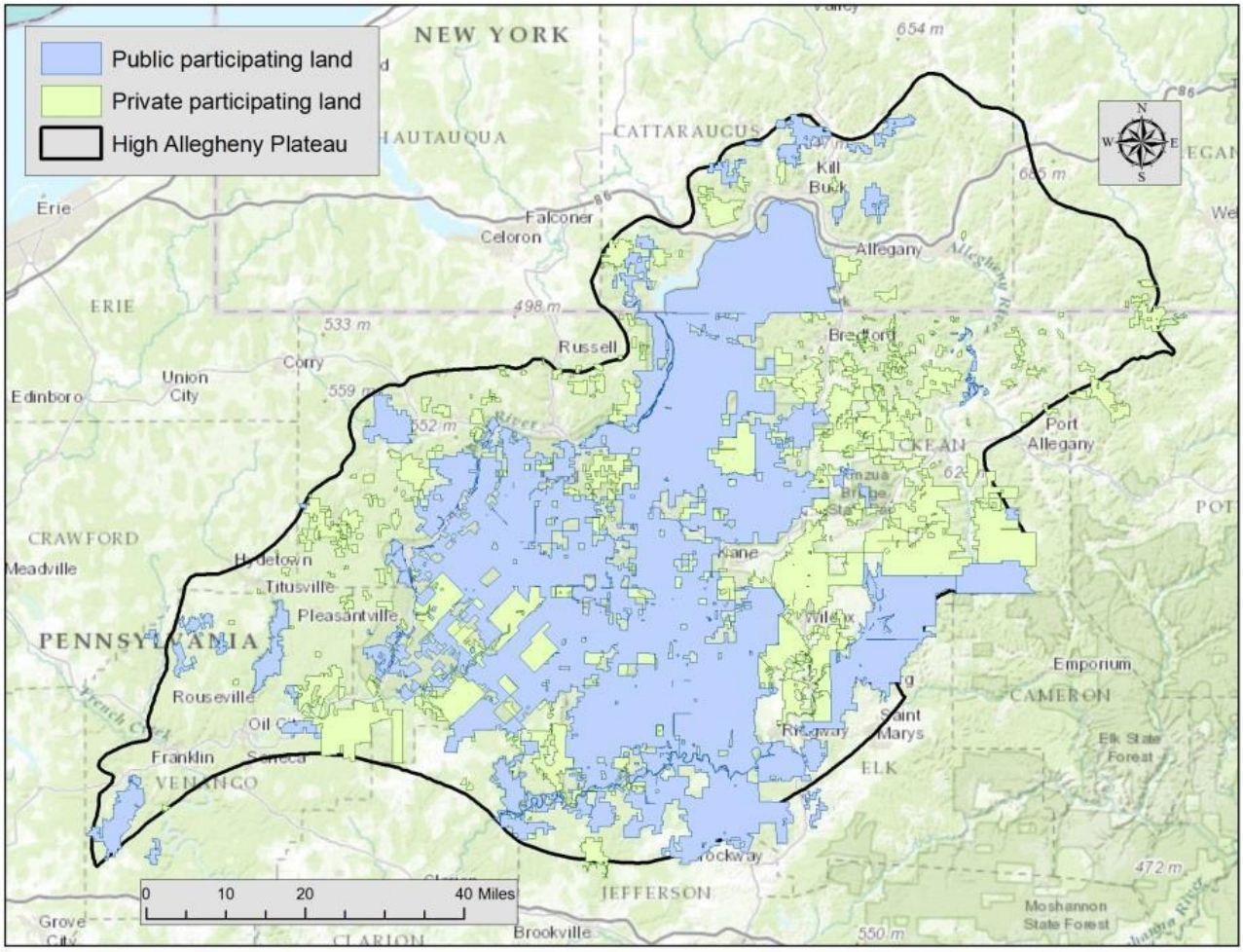

Figure 18. Public and private participating landowners in the High Allegheny Plateau Hemlock Conservation Strategy

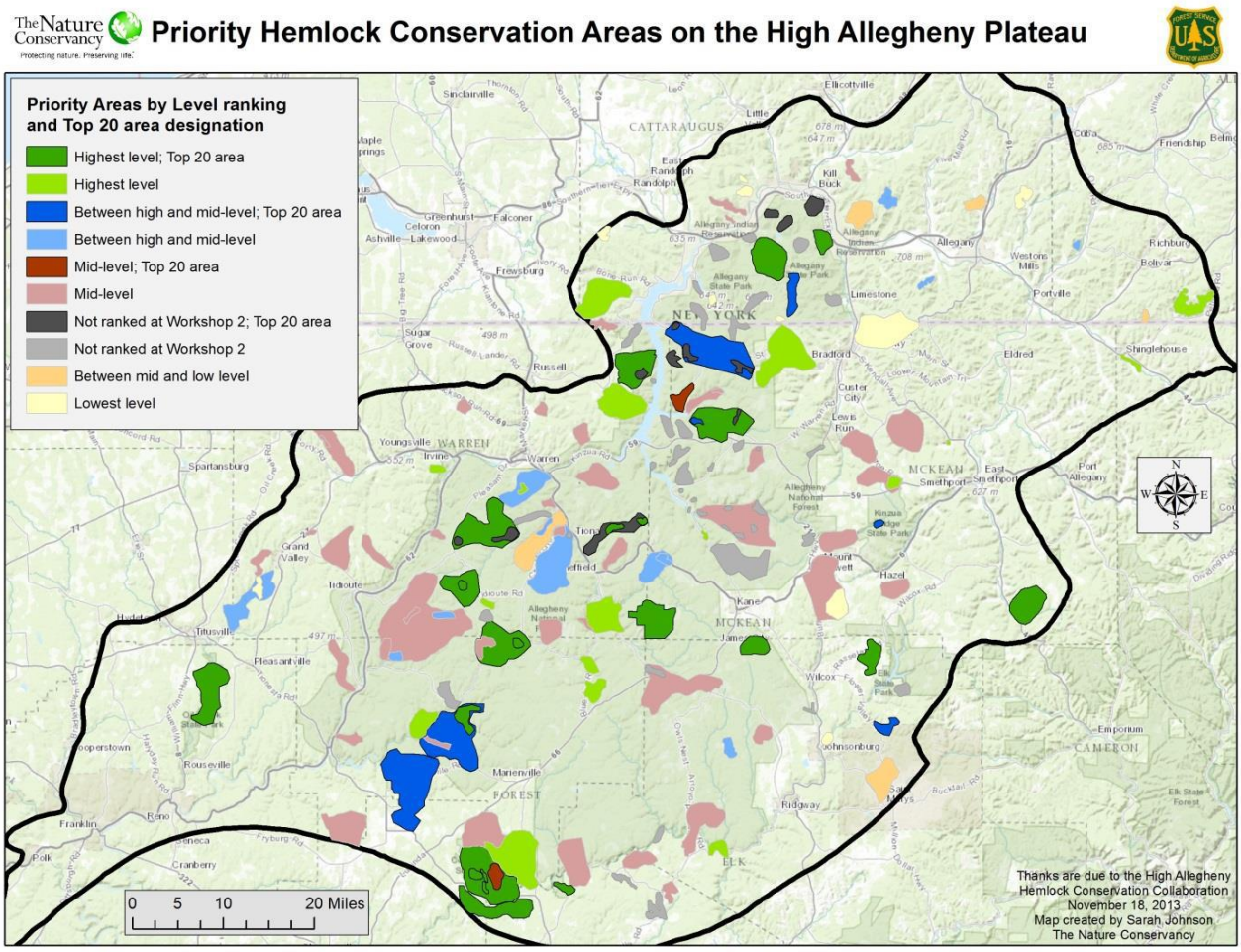

Figure 19. Priority Hemlock Conservation Areas on the High Allegheny Plateau

The products of this collaboration are available on TNC's website:

- *Web Map can be accessed here*:

http://tnc.maps.arcgis.com/home/item.html?id=a7dcd307215c4c0fb77ae7c64378d111

- *Priority Hemlock Conservation Areas shapefile can be accessed here*:

http://tnc.maps.arcgis.com/home/item.html?id=9a4ade5680df4d01a0f10fc0047d865f

- *A Readme document can be accessed through the Description section of the web map home page, the Description section of the priority areas shapefile home page, or here*:

http://tnc.maps.arcgis.com/home/item.html?id=0a2720cd3fb54f7bb709dea1b1a443e7

Part of the High Allegheny Plateau Hemlock Conservation Strategy has involved consultation with Camcore for genetic conservation of eastern hemlock. The objective of Camcore's hemlock gene conservation project is to maintain, in perpetuity, viable seed reserves and plantations of hemlock that will be available for breeding and restoration efforts once effective HWA management strategies are in place. In October 2013, a local hemlock seed collection workshop was hosted by TNC for collaborators in the hemlock conservation strategy. Robert Jetton of Camcore instructed workshop participants in assessing hemlock seed ripeness and collection protocols. Seeds from previous collections have been placed into cold storage for long-term preservation at seed repositories in Raleigh, North Carolina (operated by Camcore), and Fort Collins, Colorado (USDA-Agricultural Resource Service-National Germplasm Repository). Plantations have also been established in Brazil (Camcore member Rigesa), Chile (Camcore member Bioforest-Arauco), and the United States.

Sirex woodwasp (*Sirex noctilio*) – The introduced sirex woodwasp (SWW) is Eurasian in origin (Europe, Asia and northern Africa). The SWW leaves tell-tale damage such as resin (sap) streaks on infected trees and their attacks suppress and weaken the pine tree (Figure 20). Pine areas that are growing on poor sites that have overstocked conditions and contain overtopped/damaged trees are locations in which tree mortality caused by SWW generally occurs.

Figure 20. Sirex woodwasp damage to stem of a pine trees (Dennis Haugen, Bugwood.org**)**

The SWW was initially discovered in the northeastern United States in New York State in 2004 and in Pennsylvania, Tioga and Bradford Counties, in 2006. By 2007, SWW was identified in numerous counties in northern, central, and western New York, as well as McKean County, Pennsylvania. The McKean County initial detection site was comprised of both adult and larvae in an abandoned Christmas tree plantation of Scots pines near Kane, Pennsylvania. In 2008, it was detected in Potter County in a red pine stand.

The ANF has conducted surveys for the SWW, and there have been no SWW detections on the ANF.

In New York State, SWW has been found colonizing Scots, red, and white pines. In the Southern Hemisphere where it was also inadvertently introduced, the SWW has caused up to 80% tree mortality in exotic pine plantations, most of which contain North American pine species, such as Monterey pine. The SWW has caused severe economic damage where it has been introduced due to extensive tree mortality that infestations have caused. However, many countries have been successful in managing its presence using biological control agents such as a parasitic nematode and hymenopteran parasitoids.

Pine species comprise 3.2% of the overall basal area on the ANF and occur as concentrated plantations, in small groups, or as scattered trees. Pine species on the ANF are threatened by SWW which has been detected on other lands around the ANF. The National Insect and Disease Forest Risk Assessment predicts that the ANF may lose 3% of host species (pines) over the next 15 years.

Native tree diseases

Many native tree diseases are active on the ANF. The majority of them occur at background levels, with the exception of oak, maple, and sycamore anthracnose and leaf spot which can be locally heavy in areas, such as in 2009. These diseases rise and fall based on local environmental conditions and species mix and have been relatively stable across the forest between FY 2008 and FY 2013.

Anthracnose – Anthracnose is a leaf blight caused by a fungus native to the area. Wet, cool spring weather, such as that experienced in 2009 and 2011, promotes this disease. The severity of the outbreak varies with tree species and ranges from light to complete defoliation which results in reduced growth and the predisposition of affected trees to other stressors. The scorched, blotched, and tattered fungus-infected leaves give trees an unsightly and reddish-brown appearance that is visible from a distance.

Thousand canker disease – Thousand canker disease (TCD) was detected in Bucks County, Pennsylvania, in August 2011. This disease is caused by the fungus *Geosmithia morbida*. The fungus is vectored by the walnut twig beetle (*Pityophthorus juglandis*) which carries the fungus as it tunnels beneath the bark, causing small cankers to form. Repeated beetle attacks and the formation of multiple cankers disrupt the tree's vascular system, leading to dieback and eventual death of the tree. TCD is a threat to both commercial and wildland walnut (*Juglans*) species, including butternut trees. While it has been known to occur throughout much of the southwestern United States, it has only recently been detected in the eastern United States. The PDA has quarantined the movement of black walnut material from Bucks County.

Exotic tree diseases

Sudden oak death – Sudden oak death is caused by the plant pathogen *Phytophthora ramorum*. One of the major mechanisms of transmission is rainwater and waterways. The spores usually take advantage of a tree wound to infect a tree. Once infected, trees may display sap bleeding cankers on their trunks, and dieback of the foliage, eventually causing the death of the tree.

To date, no sudden oak death disease has been identified on the ANF.

Chestnut blight – Chestnut blight is caused by the pathogenic fungus *Cryphonectria parasitica* and was accidentally introduced to North America in the 1900s from Asia. The fungus enters the tree through wounds and grows beneath the bark eventually killing the cambium of the tree resulting in tree mortality. The blight has been present in Pennsylvania and on the ANF since the early 1900s.

The ANF, along with the Eastern Region of the Forest Service (Region 9), has been a partner in the American Chestnut Foundation's effort to develop a blight-resistant hybrid American chestnut, for eventual restoration purposes. The ANF has plans to plant approximately 600 hybrid American chestnut ("restoration chestnut") seedlings from the American Chestnut Foundation in 2014, as a progeny test of "restoration chestnut" competitiveness and blight resistance in natural settings. Similar progeny test plantings across the eastern United States will inform future restoration efforts for American chestnut.

Butternut canker – Butternut canker is caused by a fungus (*Sirococcus clavigignenti-juglandacearum*). Its origin is unknown, but it is thought that it originates from Asia. It is now found throughout the United States and Canada.

As with other fungi, it infects trees via wounds or broken branches, after which it germinates and creates cankers on the tree. The cankers eventually girdle the tree, cutting off the movement of nutrients and causing dieback. Trunk cankers eventually kill the tree.

Butternut canker caused mortality of the majority of the ANF's butternut trees in the early to mid-1900s. However, some butternut trees have survived the canker. In 2007, over 250 reported butternut trees were evaluated as part of a special project on the ANF, and 95 of these were found to be free of butternut canker. In 2008, 56 of these apparently healthy butternut trees were genetically tested by Notre Dame University researchers, with 49 of them confirmed to be pure butternut (*Juglans cinerea*). The remaining trees are either Japanese walnut (*Juglans ailantifolia*) or hybrids of the two species.

In February 2009, scion (branch) material was collected from 27 of the healthy, genetically confirmed native butternut trees. The scion were grafted to black walnut root stock. The resulting "ramets" were brought back to the ANF and planted on the Marienville Ranger District in 2012 in order to establish a seed orchard of canker-resistant butternut trees for eventual restoration purposes. The butternut orchard is being maintained and the ANF is continuing efforts to grow and restore this species.

Beech bark disease complex – The BBD complex is an exotic insect/disease complex that has cause substantial beech mortality on the ANF and in the eastern United States (USDA-FS 2007b, pp. 3-97 – 3-99). Monitoring of the advance of BBD on the ANF began in 1979. A biological evaluation of the BBD complex and integrated pest management guidelines were developed for the ANF in 1990. Annual monitoring reports since the early 1990's for the ANF have reported the impacts and spread of the BBD complex.

The insect component of the complex (a scale) was first detected on the Forest in the early 1980s, and is now present throughout the entire Forest. In 2001, the killing front covered 42% of the Forest and it continued to expand southwest through the Marienville Ranger District (Figure 21). As of 2010, the killing front of the disease complex covered the entire ANF.

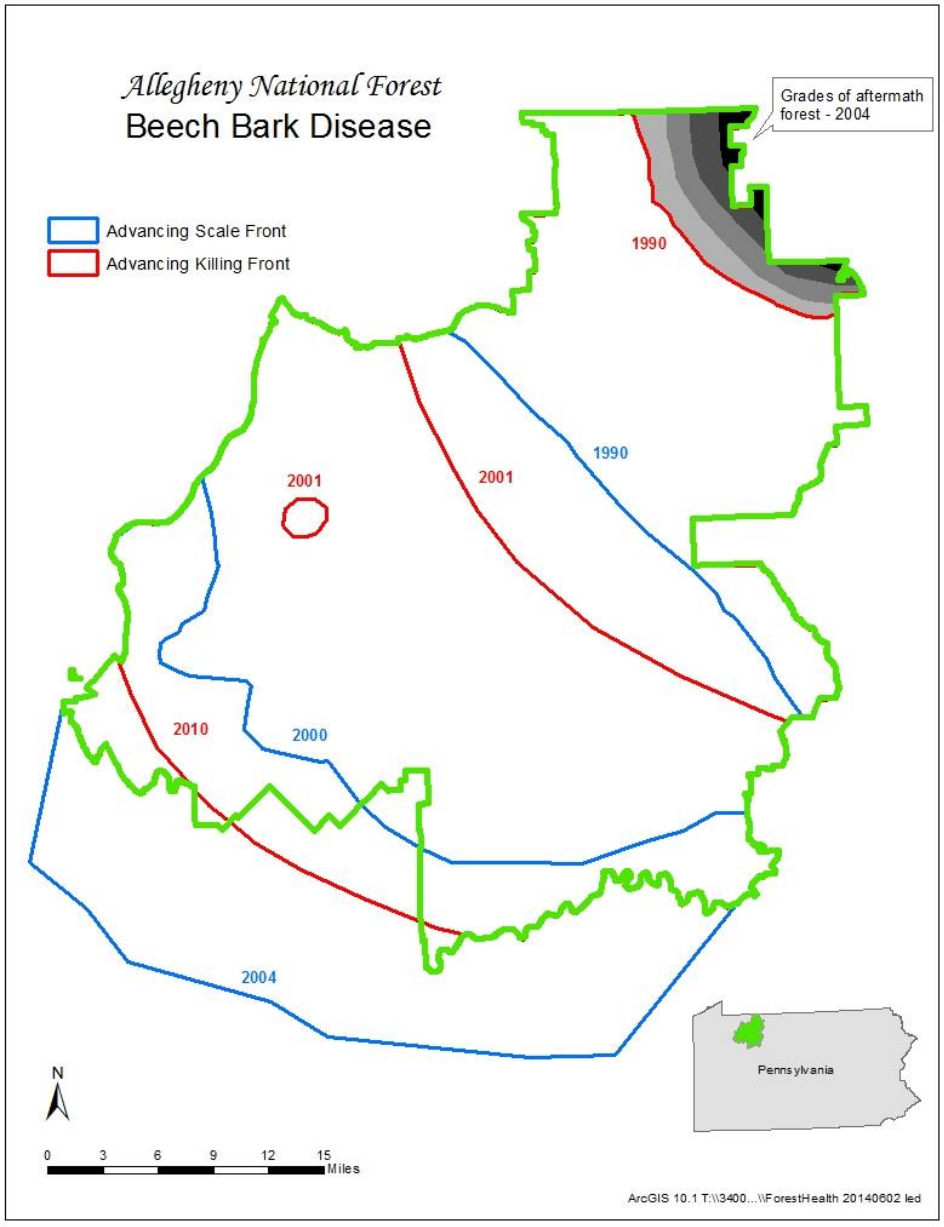

Figure 21. Map of the ANF illustrating the movement of beech bark disease across the forest

As the killing front spread across the ANF, beech decline and mortality has rapidly occurred, resulting in mortality of an estimated 60-70% of overstory beech trees during the first wave of infestation, targeting the largest individuals first (Figure 22). Subsequent waves of scale infestation result in additional mortality over time, working down through beech size classes. In FY 2009, aerial surveys identified 4,655 acres of new BBD related mortality and discoloration across the ANF. However, this was substantially less than the 44,073 acres of BBD related mortality and discoloration mapped in FY 2008. This could be due to several factors at the time of flight, including visibility and patterns of surveillance flights. It is believed that the primary factor for this observed decrease is that, as the disease progresses across the ANF, crown discoloration become less evident from the air as affected beech trees succumb and snap off or fall.

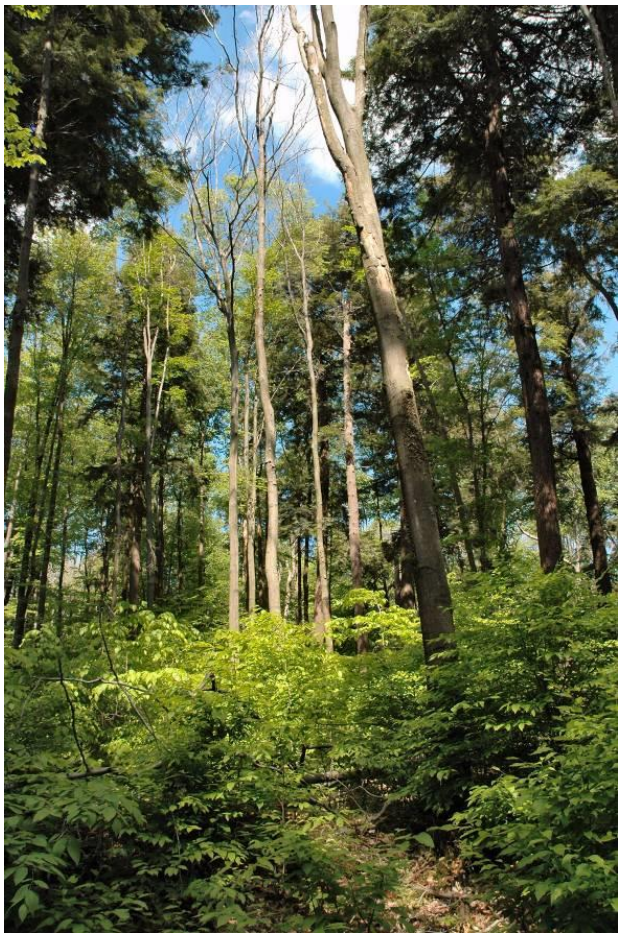

Figure 22. American beech mortality in Tionesta Research Natural Area, with beech root suckers in understory

In New England, where the BBD complex has been present and killing American beech for over 50 years, an average of half the trees die, and only 1% the trees appear immune to the complex (Houston et al. 2005). It is likely that ANF American beech are similar, with perhaps 1-5% of the trees ultimately being resistant to the disease complex (Koch pers. comm. 2013). Given the lack of landscape-level control techniques for the BBD complex, methods utilized on the ANF to address BBD primarily include silvicultural techniques to favor the resistant 1% of the American beech by discriminating against the susceptible 99%.

The National Insect and Disease Forest Risk Assessment predicts the ANF will experience an additional loss of 17% of overall American beech basal area in the next 15 years. The risk model predicts that 54% of American beech on the ANF will experience a 25% or greater loss in basal area over the next 15 years.

Forest Plan guidelines suggest that beech trees with characteristics indicating BBD resistance be retained, while discriminating against those beech trees that are susceptible to the disease complex (USDA-FS 2007a, p. 94). Marking guidelines used on the ANF since 1992 have included direction to retain American beech trees that have characteristics indicating they may be resistant to BBD complex (USDA-FS 1993). For the past twenty years, ANF personnel have

been favoring beech with smooth bark and little scale, while discriminating against beech with scale, nectria, roughened bark, tarry spots, or thinning crowns. At the same time, efforts are made to reduce overall beech abundance, particularly those beech that are susceptible to the complex in order to provide growing space for either resistant beech or other tree species.

ANF personnel have periodically participated in local training conducted by FHP personnel (Morgantown, West Virginia) and Dr. David Houston that was designed to assist ANF personnel in implementing these guidelines. Most recently, training in identifying resistant/immune beech trees was provided for ANF staff by FHP plant pathologists and entomologists in May 2010.

American beech trees that are stressed or killed by BBD complex sprout prolifically from the intact root system (Figure 22). These sprouts or root suckers are of the same genetic make-up of the parent tree, and thus susceptible to the BBD complex. These dense root sprouts prevent the regeneration of other hardwood or coniferous tree species, eventually becoming a BBD "aftermath forest" where smaller size beech brush cycles through waves of BBD. The resulting beech brush interfering vegetation is reduced through various treatments, in order to promote establishment of a diversity of tree species, including resistant healthy American beech.

In the spring of 2003, ANF personnel and plant pathologists with FHP identified over 120 healthy American beech trees in eight forest stands in the northeastern portion of the ANF, where the BBD complex has been present the longest. Most of the other beech trees in this area had succumbed to the disease complex. These trees have been periodically monitored since that time and most remain scale free to this day, indicating that they have a high probability of being resistant to the BBD.

In three of the stands mentioned above, Forest personnel are participating in a joint research project designed to test whether additional growing space created by removing or killing susceptible beech trees and beech sprouts creates sufficient growing space around resistant stems to give resistant root sprouts an advantage, thereby increasing the resistant beech composition in the young forest that develops. Shelterwood harvest and herbicide treatments have been completed in these areas, and tree regeneration monitoring is in progress.

In February and December 2008, scion (branches) were collected from 12 of the resistant American beech originally identified in 2003 (Figure 23), with the long-term objective of developing a seed orchard of trees containing genetic material from these potentially resistant trees. The scion collected were sent to NRS at Delaware, Ohio, where they were grafted to beech root stock. Once these grafted seedlings (ramets) were further challenged by beech scale to confirm their resistance to the scale insect, the ramets were planted to establish a seed orchard on Pennsylvania state land in 2011 and in 2012. Additional scion were collected from eight trees in 2010 to provide for additional genetic diversity for the future seed orchard. Seed from this seed orchard will be used for restoration of healthy American beech on the ANF and other ownerships in the future as a joint effort between the ANF, NRS, FHP, and Michigan and Pennsylvania state agencies.

Figure 23. American beech scion collected

Climate/environmental Factors

Drought – Precipitation is normally plentiful throughout the year, averaging 40 to 45 inches annually on the ANF. Between 1972 and 1987, the Forest experienced a relatively drought-free period. However, significant droughts occurred in 1988, 1991, 1995, 1999, 2001, 2010 and 2012 based on the Palmer Drought Severity Index (PDSI; less than or equal to -1, predominantly during the growing season). Between 2002 and 2009, rainfall was close to or above historical average conditions. In 2011, rainfall was above historical average conditions, and in 2013 rainfall was within normal historical ranges. Drought can be an important contributor to forest decline or tree mortality particularly when it occurs during successive years or when it is concurrent with, closely precedes, or closely follows periods of substantial tree defoliation or some other environmental or biological factor that significantly stresses the trees.

Weather conditions during 2009 were cooler than normal. Late frost and freeze events between May 19 and 25 caused damage to tree foliage, flowers, and subsequent seed production on oaks, beech and sugar maple on the ANF.

Ozone – Prolonged exposure of sensitive plants to chronic and acute ozone exposures in a predisposing environment (usually adequate soil moisture and open stomata that allow ozone to enter the plant) can result in visible foliar symptoms which are used to detect and monitor ozone stress in the forest. Ozone exposure can also lead to growth loss and biomass reduction in plants.

Ozone biomonitoring, the systematic examination of vegetation for symptoms of ozone injury, is one of the health-based indicators currently used in FIA. FIA implemented a national ozone biomonitoring program in 1994 that grew to include over 1,200 biomonitoring field sites in 47

states. The FIA biomonitoring provides information on visible symptoms of ozone rather than ozone concentrations in the air. The ANF joined the program in 1998, implementing biomonitoring procedures on an enhanced sampling grid, which continued monitoring through 2013. Forest health and biomonitoring on the ANF follows national protocols.

A recent interpretation of the ozone injury data presents a national ozone risk that indicates the ANF is currently at low risk for ozone impacts to forest ecosystems (Smith et al. 2008). Additionally, although ozone monitoring representative of the ANF shows that ozone concentrations vary from year to year, the ozone concentration is currently below the National Ambient Air Quality Standard (NAAQS) and in attainment (< 75 ppb) based on ozone monitoring sites at the Kane Experimental Station (KEF) Clean Air Status and Trends NETwork (CASTNET) site 112 (Figure 24) and Erie, Pennsylvania (Table 3 under Air Quality). The three-year average at the KEF CASTNET site 112 for 2010-2012 was 67 ppb (USEPA 2013a).

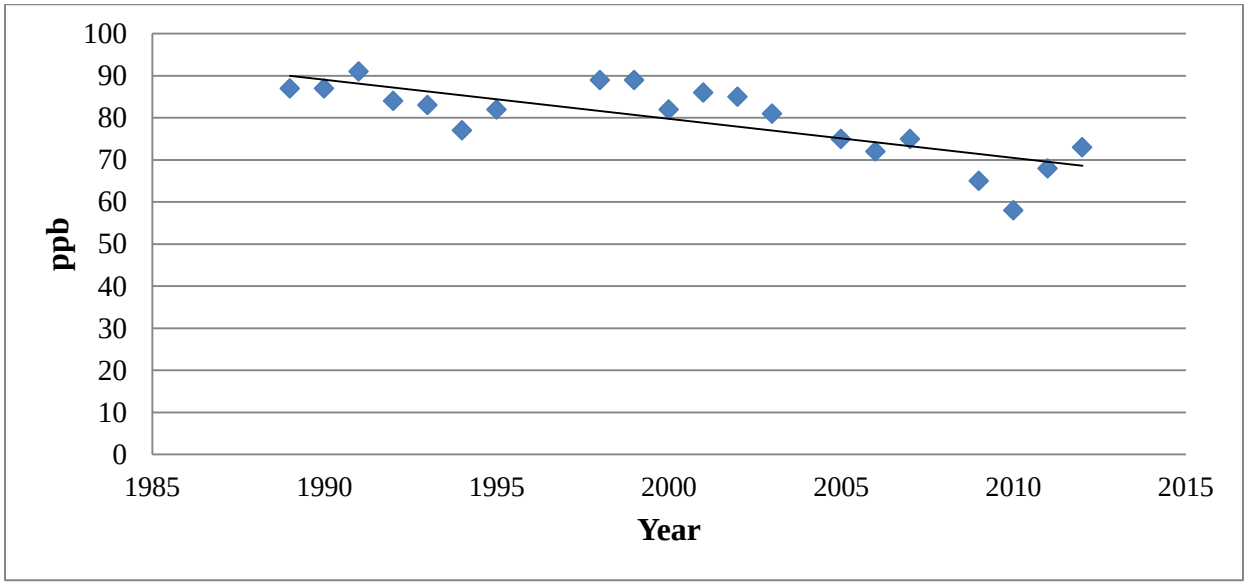

Figure 24. Annual fourth highest 8-hour daily maximum ozone concentration (EPA standard) as measured at the Kane Experimental Forest Clean Air Status and Trends NETwork site 112

The average biosite index value (a measure of ozone damage to ozone sensitive plant species) was determined for inventoried sites in Pennsylvania (ranged from 48 to 134 sites per year) and the ANF (the number of plants evaluated ranged from 2,229 to 11,147 per year) between 1998 and 2007 (Figure 25). While there was an overall downward trend in ozone injury conditions for both Pennsylvania and the ANF, there were fluctuations within the monitoring period.

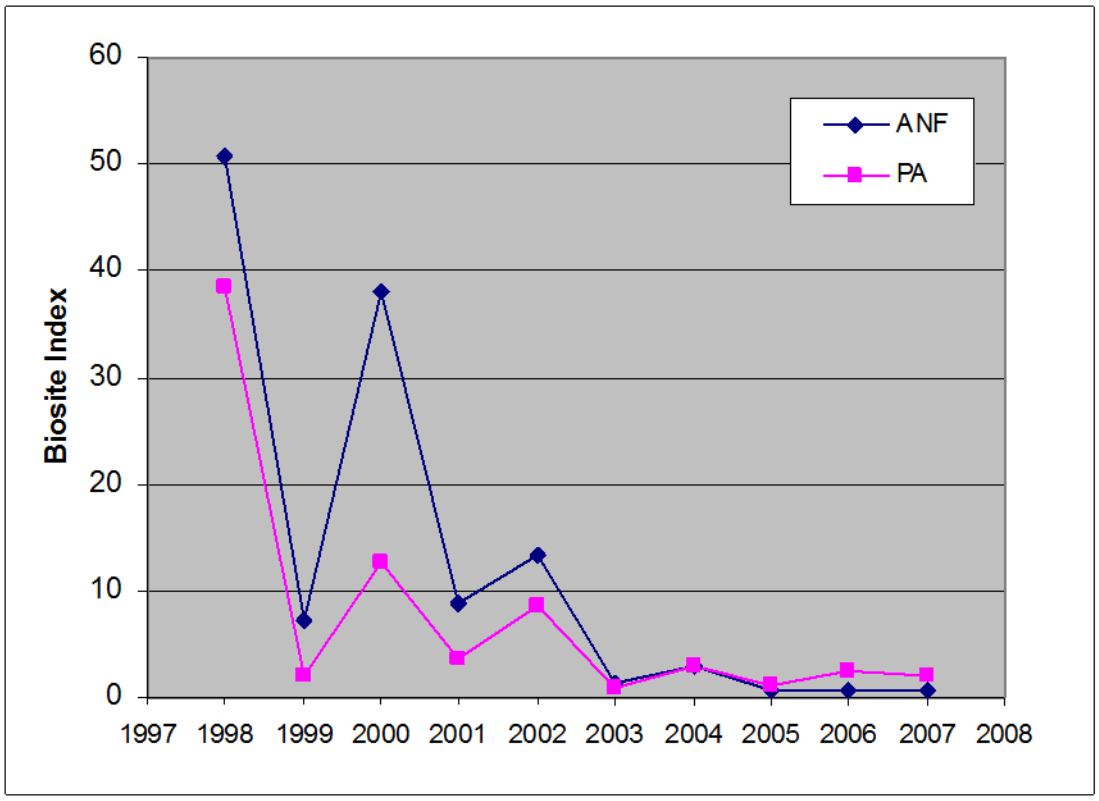

Figure 25. Biosite index for the ANF and Pennsylvania (FY 1998-2007)

No ozone biomonitoring occurred in 2008. In 2009, ozone biomonitoring on the ANF resumed, and has continued through 2013. In 2009, 14 plots were visited, and ozone injury was recorded at one plot. In 2010, 16 plots were visited, and ozone injury was recorded at one site. In 2011, 16 plots were visited and no ozone injury was recorded. In 2012, eight plots were visited and no ozone injury was recorded. In 2013, 15 plots were visited, and ozone injury was recorded at five sites.

Some of the variability from 1998 through 2007 can be explained by drought conditions such as in 1999 and 2001 (Figure 26). During a drought, ozone uptake by plants is prevented when the leaf stomates, which allow for the exchange of gases with the atmosphere, are closed. This effectively reduces foliar injury response of ozone sensitive species. A most recent summary of regional ozone biomonitoring indicated that although the percent injured plants and the biosite index declined from 1994 to 2010, the percent of injured sites showed a less obvious downward trend (Smith et al. 2012).

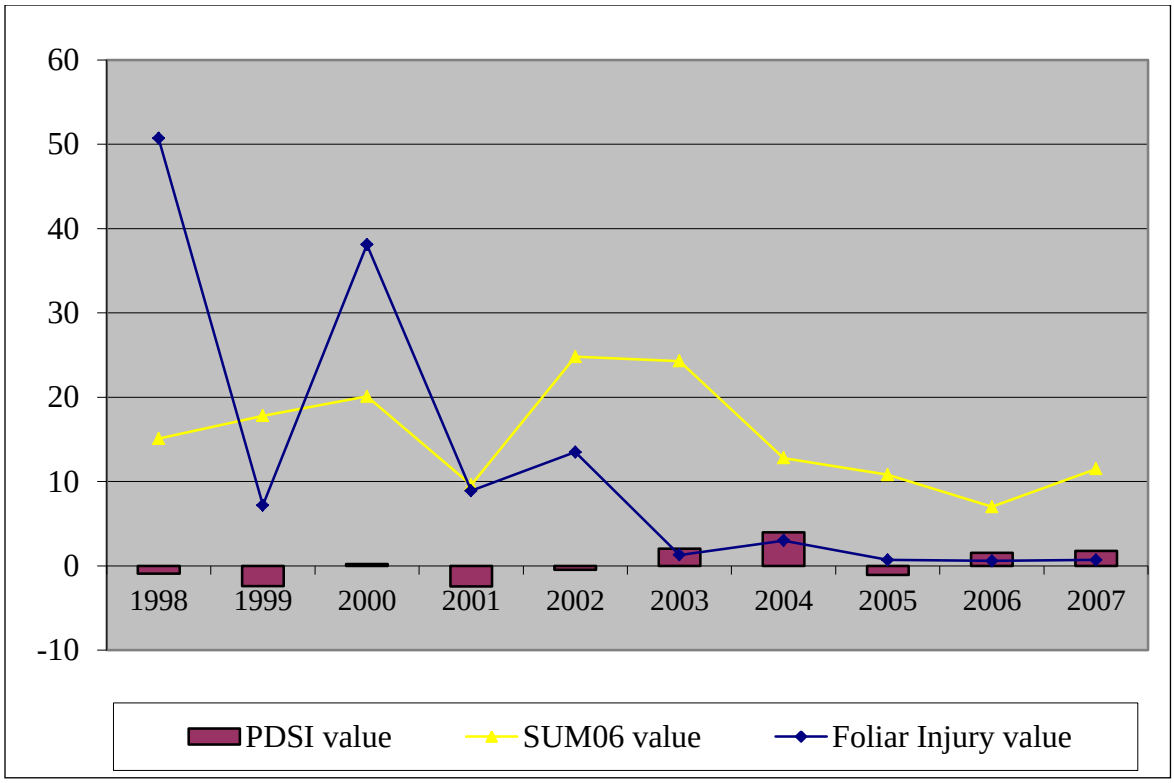

Figure 26. Foliar injury (biosite index values), soil moisture (PDSI values), and ozone exposures (SUM06 values) for the ANF (FY 1998-2007)

Site/species nutrient capability – There is no new information to report.

Atmospheric deposition – Deposition of sulfur and nitrogen compounds as sulfate (SO_4) and nitrate (NO_3) can cause harmful effects to both aquatic and terrestrial ecosystems. SO_4 and NO_3 deposition can cause stream acidification and leaching of important soil nutrients, as well as cause harmful effects to both aquatic and terrestrial systems. NO_3 can also cause eutrophication, or nutrient enrichment, that negatively impacts water quality, aquatic biota, and may increase invasive species growth, particularly plants. SO_4 is a product of sulfur dioxide produced primarily from the combustion of coal at electrical generating units, while NO_3 is a product of nitrogen oxides derived from both the combustion of fuel at very high temperatures (such as in power plants, industrial boilers, and automobiles) as well as from various agricultural processes.

Deposition can occur in three forms: dry, wet, and cloud. Dry deposition is the direct fallout of fine particulates and gases from the atmosphere. Dry SO_4 is less than 4% of the total sulfur deposition and dry NO_3 is less than 1% of the total nitrogen deposition as measured at KEF112 for the years 2010-2012 (USEPA 2014a). Wet SO_4 is the largest component of sulfur deposition during this period and wet NO_3 is the largest component of nitrogen deposition during this period (USEPA 2014a). Wet deposition occurs when acidic pollutants combine with water in the atmosphere, which is then deposited in the form of rain, snow, or hail. Cloud deposition occurs when droplets of acid-containing water from clouds are deposited onto the earth's surface, typically at higher elevations.

Deposition monitoring of wet SO_4 and wet NO_3 is measured on the ANF at the National Atmospheric Deposition Program/National Trends Network (NADP) monitoring station. The

NADP site on the ANF (PA29) is located at the KEF. Wet deposition of SO_4 and NO_3, as well as acidity (measured as pH) for 1985 through 2012 are shown for PA29 in Figures 27, 28, and 29 (NADP 2013). Over the past two decades plus, the precipitation continues to be acidic, but it is much less acidic now than it was during the 1980s due to pollution controls required by the Clean Air Act.

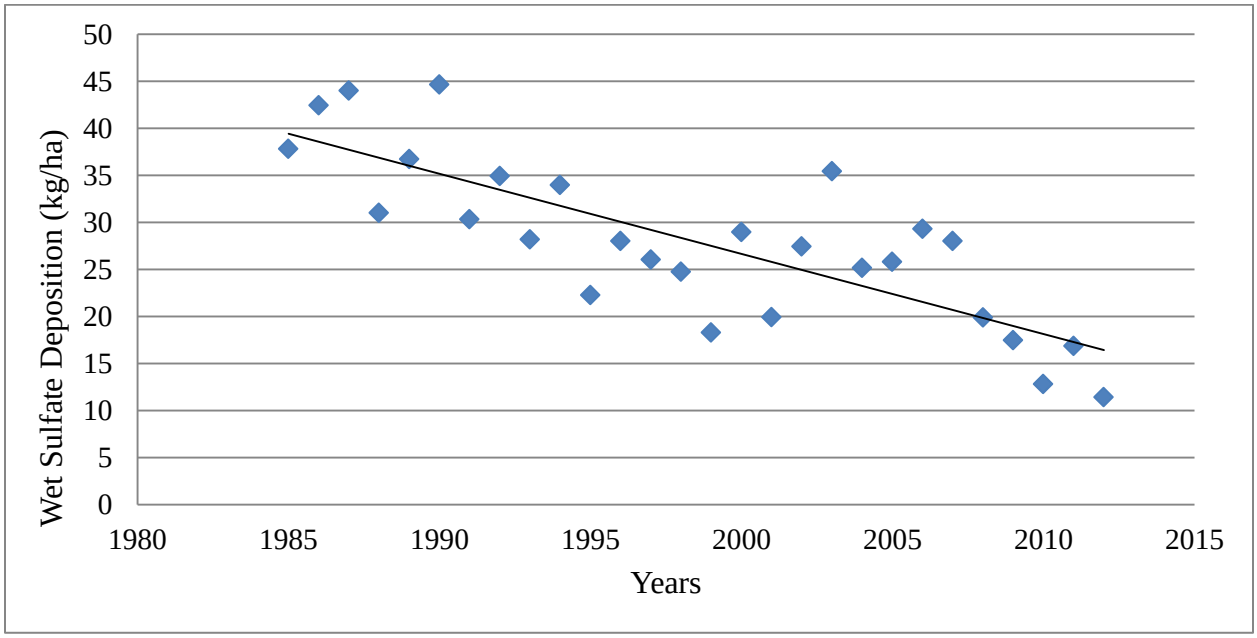

Figure 27. Wet sulfate deposition as measured on the ANF at the National Atmospheric Deposition Program/National Trends Network monitoring station (PA29) at the Kane Experimental Station (1985-2012)

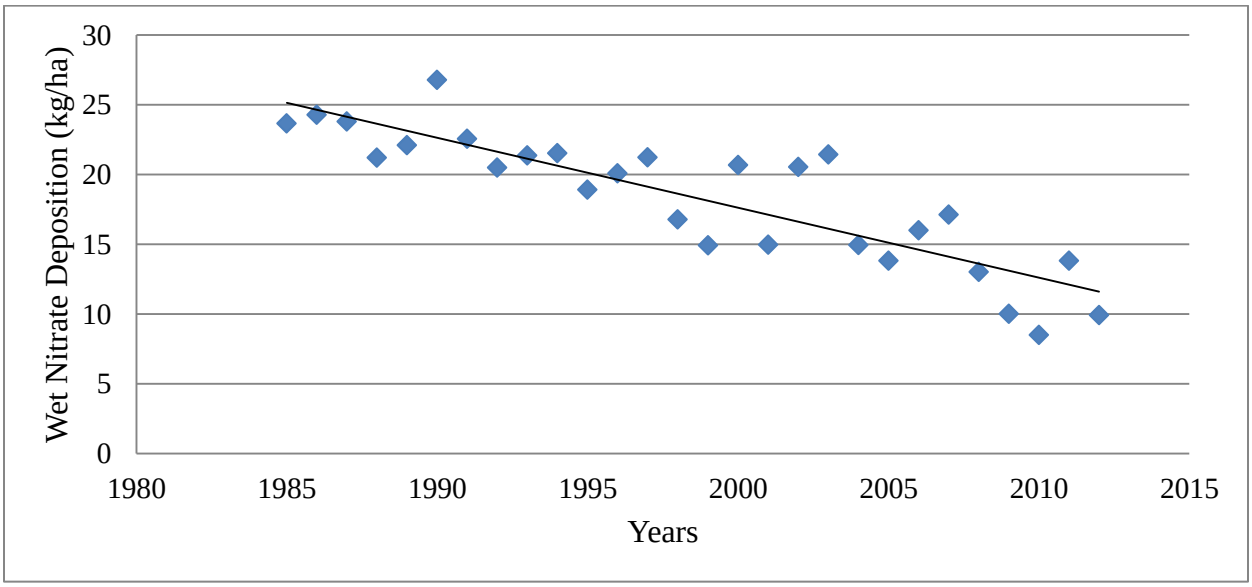

Figure 28. Wet nitrate deposition as measured on the ANF at the National Atmospheric Deposition Program/National Trends Network monitoring station (PA29) at the Kane Experimental Station (1985-2012)

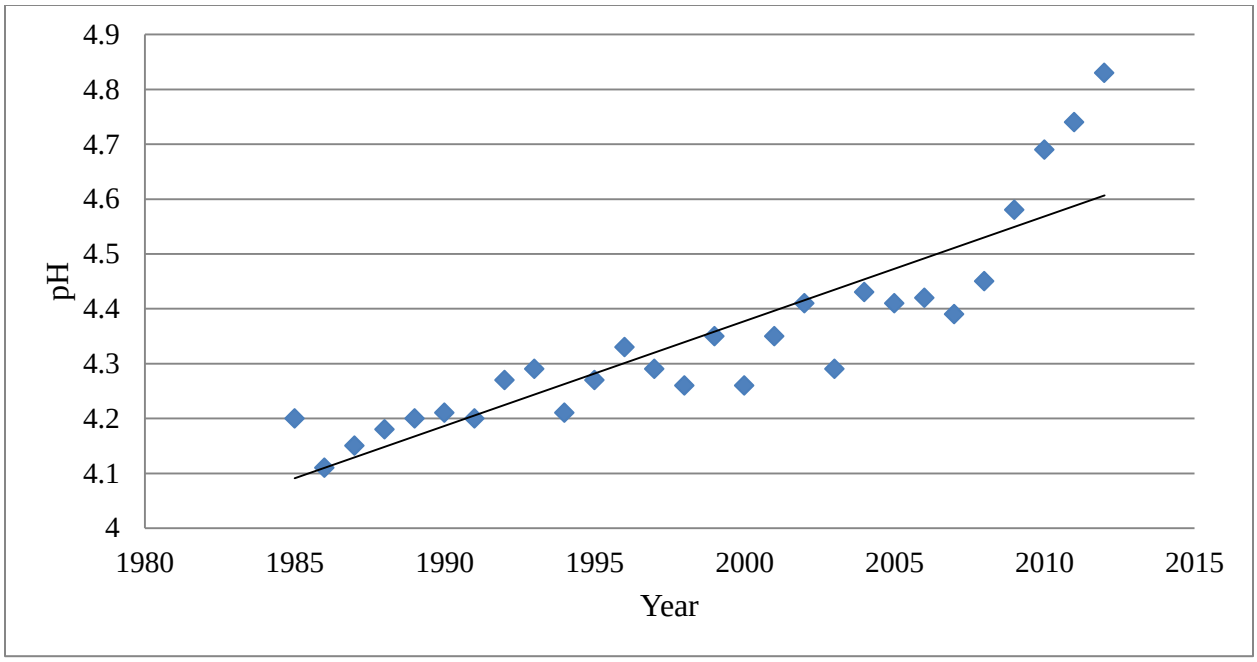

Figure 29. Acidic deposition (pH) as measured on the ANF at the National Atmospheric Deposition Program/National Trends Network monitoring station (PA29) at the Kane Experimental Station (1985-2012)

Mercury is not one of the six criteria pollutants listed in the NAAQS, but it is another important environmental contaminant that reaches the Forest through atmospheric deposition. The primary source of anthropogenic mercury is the combustion of coal. Mercury is relatively stable and accumulates in the environment until conditions are right for conversion to its most toxic form, methyl mercury (MeHg). Mercury deposition monitoring values do not indicate how mercury will be altered in the environment to produce MeHg. Various environmental characteristics within a watershed influence the methylation of mercury, including the percentage of wetland acres and the depth of lakes receiving deposition (Sams 2007). The MeHg is ingested by aquatic organisms and bioaccumulates as it makes its way through the food chain, finally affecting humans when fish are consumed. Unhealthy levels of MeHg have led to fish consumption advisories in many states, including Pennsylvania. MeHg has also been found in numerous species of wildlife, such as loon and mink.

Mercury deposition is measured at KEF as part of the Mercury Deposition Network (MDN). The KEF mercury site (PA29) has been operational since 2010. Values show a wide variation at the PA29 site (Figure 30).

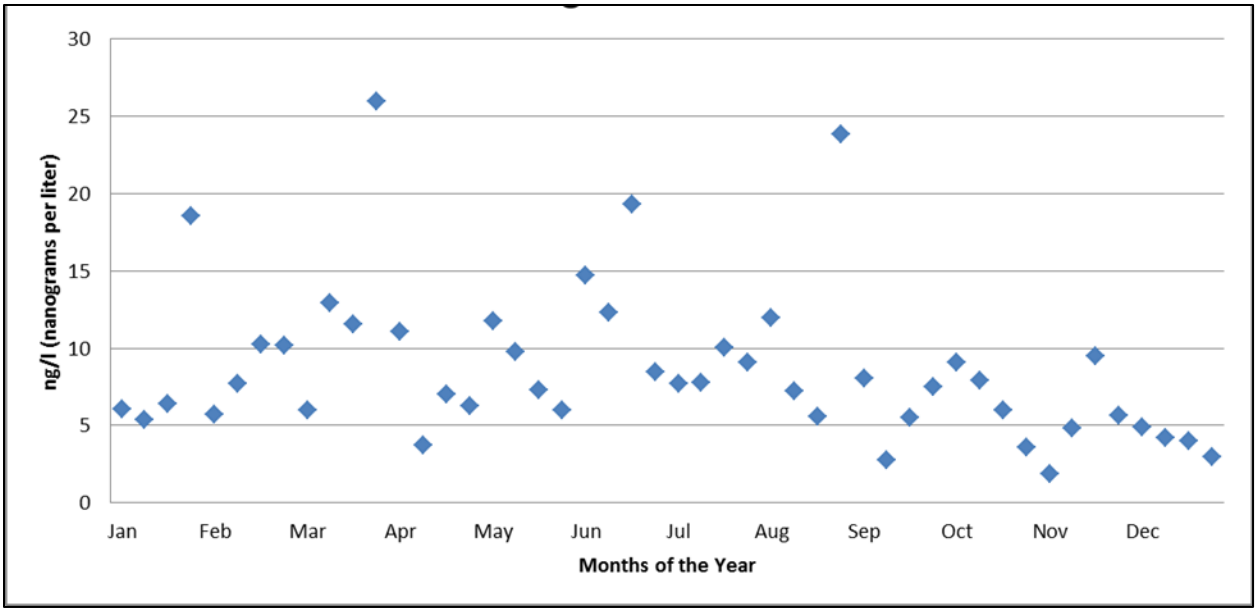

Figure 30. Mercury concentration deposition as measured on the ANF at the Mercury Deposition Network site (PA29) at the Kane Experimental Station (January – December 2012)

Air quality – The Clean Air Act, last amended in 1990, requires the United States Environmental Protection Agency (EPA) to set NAAQS for six common air pollutants (USEPA 2013b). These "criteria pollutants" are commonly found and can be hazardous to human health, the environment, and can potentially cause property damage. The EPA regulates these six pollutants by setting scientifically-based permissible levels. The six criteria pollutants identified by the EPA are: ground-level ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5,\ 10}$), and lead (Pb).

O_3, which occurs naturally in the stratosphere, protects life on Earth. However, ambient, or ground-level O_3 (smog), is a harmful secondary pollutant which is not emitted directly from a stack or tail-pipe. Rather, O_3 is formed when nitrogen oxides (NO_x) and volatile organic compounds (VOC) combine in the presence of heat and sunlight. Nitrogen oxides come primarily from burning fossil fuels at high temperatures; VOC are emitted from vehicles, industrial processes, and primarily from natural sources such as trees and shrubs. Research has shown that in the eastern United States there is an over-abundance of naturally-occurring VOC. O_3 formation on the ANF is therefore "NO_x-limited", which means that the concentration of ambient O_3 is primarily dependent on the amount of NO_x emitted into the air. Pennsylvania O_3 levels are attributable to local influences and, to a more significant extent, to O_3 and O_3 precursors transported from outside Pennsylvania from states to the south and west (PADEP 2009a).

SO_2 is a highly reactive gas which has adverse effects on the respiratory system and 93% of SO_2 emissions are created by fossil fuel combustion at power plants and other industrial facilities (USEPA 2014b). Other sources include industrial processes such as extracting metal from ore, and burning high-sulfur-containing fuels by locomotives, large ships, and non-road equipment.

CO is formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes over half of CO emissions nationwide. Other sources include construction equipment, industrial processes, and wood burning.

NO_x are a group of highly reactive gasses for which NO_2 is the indicator. Emissions from cars, trucks, buses, power plants, and off-road equipment create NO_2 which contributes to ground-level O_3, and fine particle pollution.

Particulate matter is composed of small particles and liquid droplets which can be inhaled and affect the heart and lungs. Particulate matter between 2.5 and 10 micrometers (PM_{10}) are "inhalable coarse particles" found near roadways and dusty industries. Particulate matter 2.5 micrometers and smaller ($PM_{2.5}$) are "fine particles" found in emissions from motor vehicles and wood burning, and can cause reduced visibility or regional haze over large areas. Most states have finalized Regional Haze State Implementation Plans for controlling emissions that will reduce visibility impairing pollutants that affect the ANF. Historically, the ANF has had some of the poorest visibility in the nation, primarily due to fine ammonium sulfate particles in the atmosphere (Hand et al. 2011); however, based on fine particulate measurements taken at Maurice K. Goddard State Park since 2001, southwest of ANF, and considered representative of ANF, visibility has improved over roughly the past decade by about 4% per year (FED 2012) due to emission reductions upwind.

Pb smelters are the leading cause for Pb emissions and, to a lesser extent, waste incinerators, utilities and lead-acid battery manufacturers. The nearest Pb smelter is located in southwestern Pennsylvania, about 128 miles from the ANF.

Monitoring of the NAAQS occurs at the state level and is enforced through EPA-approved State Implementation Plans. The plans typically include a collection of monitoring devices throughout the state which provide actual measurements of the concentrations in the air and identify whether an area is meeting the air quality standards. Areas which meet the standards are considered in "attainment" status, while those that do not meet the standards are considered in "nonattainment" status. States with nonattainment areas must implement strategies which will reduce emissions.

The nearest EPA-approved monitoring stations for O_3, CO, NO_2 and $PM_{2.5, 10}$ are located in Erie, Pennsylvania. There is an EPA-approved monitor for SO_2 located in the city of Warren, Pennsylvania. The nearest monitor for lead is located in Beaver County (USEPA 2013b).

Currently, the four-county area of Pennsylvania, in which the ANF is located, is in attainment of all the NAAQS except SO_2 (Table 3; USEPA 2013c). Effective October 4, 2013, an area consisting of Conewango Township, Glade Township, Pleasant Township, and the City of Warren were designated as a nonattainment area for pollutant SO_2 (USGPO 2013). The Commonwealth of Pennsylvania is directed by the Clean Air Act to meet the 1-hour SO_2 standard for this newly designated nonattainment area as expeditiously as practicable, but no later than October 4, 2018 (USGPO 2013). A portion of the newly designated SO_2 nonattainment area, in the vicinity of the City of Warren, is within the proclamation boundary of the ANF.

Table 3. National Ambient Air Quality Standard criteria pollutant attainment status

Criteria Pollutant	Averaging Time	Level	Attainment (USEPA 2013c)
O_3	8 hour	75 ppb	Yes
SO_2	1 hour	75 ppb	No
CO	8 hour	9.0 ppm	Yes
NO_2	1 hour	100 ppb	Yes
PM_{10}	24 hour	150 µg/m^3	Yes
$PM_{2.5}$	Annual	12 µg/m^3	Yes
Pb	3 month average	0.15 µg/m3	Yes

The National Energy Technology Laboratory constructed an air quality monitoring laboratory to measure ambient concentrations at three locations during a seven month period from 2010-2011 on the ANF (Figure 31). The focus of the laboratory deployment was to try to determine if an area relatively unimpacted by OGD would have different air quality from two sites that were located near oil and natural gas development activities. The study concluded (Pekney et al. 2014):

> Concentrations of criteria pollutants O_3 and NO_2 did not vary significantly from site to site; averages were below NAAQS. Concentrations of VOC associated with oil and natural gas (ethane, propane, butane, and pentane) were highly correlated. Differences between the two impacted and one background site were difficult to discern, suggesting that the monitoring laboratory was a great enough distance downwind of active areas to allow for sufficient dispersion with background air such that the localized plumes were not detected.

Figure 31. The National Energy Technology Laboratory air quality monitoring laboratory

Wind events – Wind events are a fairly common disturbance on the ANF. Wind events impacted the ANF in a storm that occurred in July of 2012, predominantly affecting areas on the Marienville Ranger District. Over 800 acres of scattered and concentrated blown down trees were mapped following the July 2012 storm.

Ice storms - There is no new information to report.

Conclusions – Numerous stressors, native and introduced insects and diseases threaten the health of ANF forest ecosystems. Recent introductions of HWA and EAB are of particular concern. Continued mortality and changes in forest structure resulting from BBD continues to be of concern on the ANF. These factors alter natural disturbance regimes and change stand trajectories, changing forest composition, structure and function. A number of management activities, projects, and strategies on the ANF are specifically designed to reduce impacts from destructive insects and diseases.

Recommendations – Continue insect and disease detection and monitoring activity as a cooperative effort with FHP. Maintain health of forest stands by maintaining adequate growing space and site resources through thinning. Enhance the diversity of forest vegetation in terms of composition and structure, in order to improve resiliency of the forest and reduce level of impact from insects and diseases, particularly those that are introduced.

ANF Forest Plan direction provides for emphasizing integrated pest management methods to prevent or minimize pest problems, using the most current science and available control methods. For those insects and diseases that present new threats to Forest tree species (such as WAB, HWA, and SWW), continue monitoring for their presence on the ANF, and develop and implement strategies and action plans for these pests that integrate newly identified or state-of-the-art pest control techniques. Continue monitoring overall health and status of affected tree species. Continue to assess the need for public education (firewood movement) and monitor effectiveness of education and outreach efforts.

Management Indicator Species – cerulean warbler

Population trend, locations, and population estimate

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Cerulean warbler	What is the population trend of cerulean warbler? Where has this species been documented? What is the ANF population estimate?	Annual	5 Years	B

Protocol – Document cerulean warbler (*Setophaga cerulea*) occurrence during songbird survey drive routes and survey suitable nesting habitat using tape playback calls. Also, review the Second Atlas of Breeding Birds in Pennsylvania (Wilson et al. 2013). The Pennsylvania Breeding Bird Atlas provides species distribution maps that reflect the breeding bird behavior categorized by breeding evidence observed during surveys.

Annual songbird survey drive routes were chosen so that a variety of habitats were traversed. Routes were completed between dawn and 0930 with stops made every ½ mile. All singing birds were documented for five minutes. The number of routes completed varied from year to year.

Callback surveys were conducted during Pennsylvania Breeding Bird Safe Dates (June 1 – July 31) between dawn and 0930. Survey points were approximately 200 meters apart. The call was played for 60 seconds and the surveyor then listened for 90 seconds before playing the call for another 60 seconds and then moving on to the next survey point.

In addition to the songbird surveys conducted by ANF staff, several research projects conducted by NRS staff have been set up to address interior forest bird species using audible point counts or mist netting. These projects spanned the FY 2008 through FY 2013 monitoring period.

Results – Table 4 documents cerulean warbler observations from FY 2008 through FY 2013. Observations were made during the breeding season unless otherwise noted. Most of the observations were associated with a NRS research project at either an audible point count or mist net capture. Differences among years reflect highly varying intensities, focus, and geographic scope of research efforts: survey efforts peaked in FY 2009, and decreased in FY 2010 and FY 2011, when cerulean work focused on a subset of nesting areas. Observations in FY 2012 and FY 2013 were incidental based on research projects not conducted on cerulean warblers or in preferred cerulean habitat.

Table 4. Cerulean warbler observations (FY 2008-2013)

Year	Individuals Observed
2008	53
2009	154
2010	42
2011	17
2012	4
2013	3 7[1] 3[2]

1 – Non-reproductive (outside of breeding season)
2 – Non-reproductive (outside of breeding season during migration period)

The possible, probable, and confirmed breeding behavior by cerulean warblers documented state-wide changed by 35%, -36%, and -22%, respectively between the first breeding bird atlas (1983-1989) and the second (2004-2009; Figure 32). This represented a 7% decrease overall across the three status categories; however, point counts conducted on the ANF as part of the second Pennsylvania Breeding Bird Atlas found National Forest System (NFS) lands along the Allegheny Reservoir to support some of the highest densities of cerulean warblers in the state (Wilson et al. 2013).

Cerulean Warbler (number of blocks)

Status	first Atlas 1983 - 1989	second Atlas 2004 - 2009	Change %
Possible	324	437	35
Probable	430	275	-36
Confirmed	82	64	-22
Total	836	776	-7

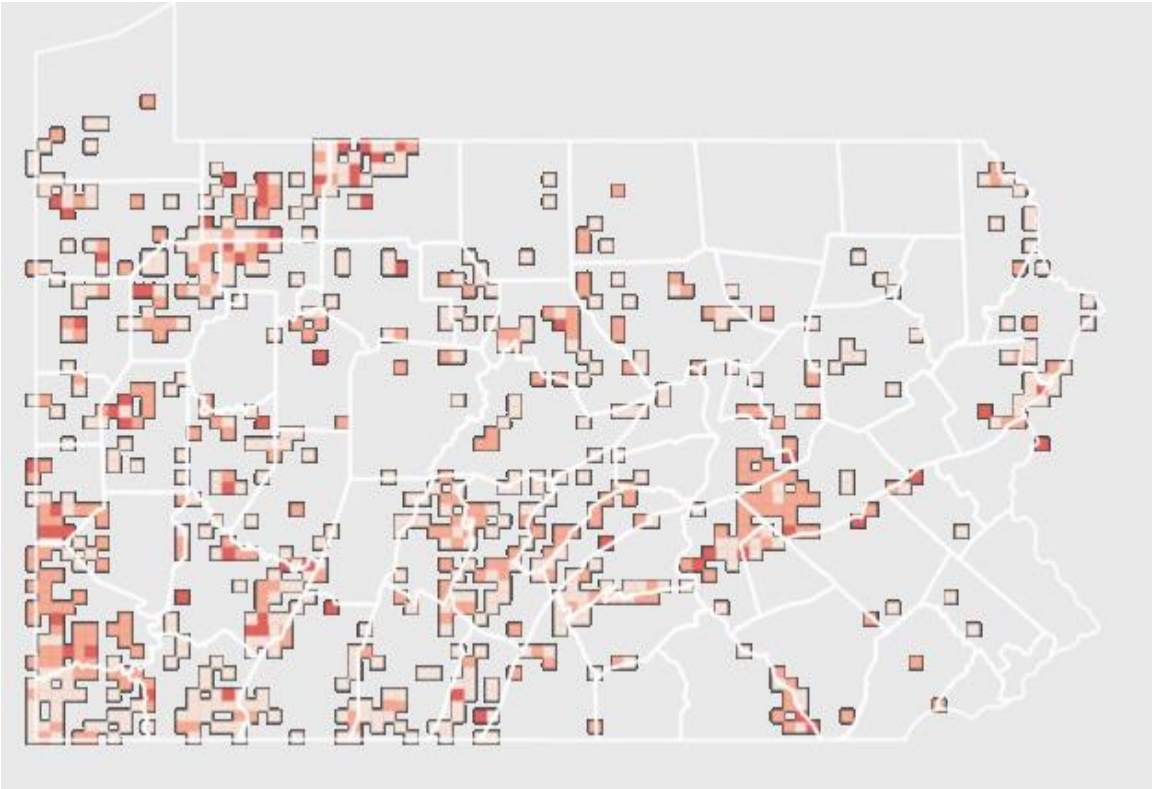

Figure 32. Pennsylvania-wide breeding status of cerulean warblers from the Second Atlas of Breeding Birds in Pennsylvania

Conclusions – Prior to this reporting period, breeding bird surveys were conducted between 1991 and 2005 on transects established across the ANF. Eighty-nine singing males were documented during this effort, including 27 on non-Federal lands and 62 on the ANF. Based on the availability of oak habitat in 2006, it was estimated that the ANF could support between 500 and 1500 pairs of cerulean warblers, with higher densities occurring on sites that provide optimum habitat conditions (USDA-FS 2007b, p. 3-199).

Based on documented occurrences from songbird routes, callback surveys, NRS research projects, and the second Pennsylvania Breeding Bird Atlas as well as availability of preferred nesting habitat (estimated to support roughly as many breeding pairs as did 2006 habitat conditions; see *Cerulean warbler – suitable habitat and activities within oak forest community*), the ANF population of cerulean warblers appears to not be suffering the decline reported in other parts of the state.

Suitable habitat and activities within oak forest community

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Cerulean warbler	What activities have occurred within the oak forest community? How many acres of suitable habitat exist?	Annual	5 Years	B

Protocol – Suitable habitat on the ANF was summarized using vegetation data in the Field Sample Vegetation (FS Veg) database, and activities implemented within the oak forest community between FY 2008 and FY 2013 were compiled from the FACTS database.

Cerulean warbler suitable habitat includes all seventh order watersheds that contain an oak component and riverine habitat; however, preferred nesting habitat falls within mature oak forests older than 50 years old, and 50 – 100% stocked (USDA-FS 2007b, p. 3-199 – 3-200).

Results

Activities within oak forest community

Table 5. Activities implemented within oak and mixed oak forest types (FY 2008-2013)

Activity Description	Acres
Shelterwood Establishment Cut (With or Without Leave Trees)	230
Commercial Thinning	301
Sanitation Cut	9
Control of Understory Vegetation – Burning	157
Site Preparation for Natural Regeneration – Burning	108
Broadcast Burning (Majority of Unit)	26
Underburn – Low Intensity (Majority of Unit)	3.2
Total	**834.2**

Preferred nesting habitat

Table 6. Preferred cerulean warbler nesting habitat

Use	2006 (Acres)	Current Condition (Acres)	Percent of Oak Forest Type
Suitable (Mature Oak/Riverine 75 – 100% Stocking)	40,200	41,861	51%
Optimum (Mature Oak/Riverine 50 – 75% Stocking)	19,800	16,998	21%

Conclusions – Preferred nesting habitat on the ANF has dropped slightly since the start of 2007 Forest Plan implementation, and represents 72% of oak forest types on the ANF.

Relationship between trends in habitat and populations

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Cerulean warbler	What is the relationship between trends in habitat and populations?	Not applicable	5 Years	B

Protocol – Compare results of *Cerulean warbler – population trends, locations, and population estimate* with the current condition of preferred nesting habitat (see *Cerulean warbler – suitable habitat and activities within oak forest community*).

Results – See *Cerulean warbler – population trends, locations, and population estimate* and *Cerulean warbler – suitable habitat and activities within oak forest community*.

Conclusions – Preferred nesting habitat on the ANF has dropped slightly since the start of 2007 Forest Plan implementation. Also, based on documented occurrences from songbird routes, callback surveys, NRS research projects, and the second Pennsylvania Breeding Bird Atlas, the ANF population of cerulean warblers appears to not be suffering the decline reported in other parts of the state. These trends in habitat and the cerulean warbler population align with the management emphasis that was included in the Forest Plan FEIS for the species (USDA-FS 2007b, p. 3-201):

- Minimize the loss of the oak forest community (see *Provide minimum oak component*);
- Maintain > 70% of the oak forest type as suitable cerulean warbler nest habitat (i.e. >50 years of age; see *Cerulean warbler – suitable habitat and activities within oak forest community*); and
- Provide habitat conditions capable of supporting a minimum of 1200 pairs of cerulean warblers (see *Cerulean warbler – population trends, locations, and population estimate*).

Preliminary data from new cerulean research initiated in FY 2014 indicate that focal populations of cerulean warbler on the ANF have remained stable (e.g., FR 262), or grown in size (e.g., cerulean

warblers seem to have responded very positively to controlled burns in two stands along FR 449) compared to numbers from the same sites in FY 2006-2009.

Cerulean warbler recommendations – Continue to survey cerulean warbler preferred nesting habitat during songbird survey routes. Implement the cerulean warbler monitoring study proposed for the Salmon West project with the objective of determining if cerulean warblers respond to structural changes to oak forest due to silvicultural treatments. Continue to maintain the integrity of cerulean warbler habitat by implementing the management emphasis outlined in the Forest Plan FEIS.

Management Indicator Species – northern goshawk

Population trend, active territories, and young produced

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Northern goshawk	What is the population trend of northern goshawk? How many northern goshawk nesting territories exist on the ANF and of these, how many are occupied? How many young were produced?	Annual	5 Years	B

Protocol – The Central Appalachian Goshawk Project (CAGP) began in 1994 with the monitoring of recently discovered northern goshawk (*Accipter gentilis*) territories in the high elevations of the Monongahela National Forest in West Virginia (Buckelew 1991). During the 1990s, goshawk populations in the Northeast and Central Appalachians (WV-MD-PA) were considered by most eastern raptor biologists to be in good condition and increasing. From 1990 through 2000, nesting pairs expanded from the very rare occurrence in Maryland (1980, 1988, and 1996) to several pairs documented each summer during the period 2002-2006 (Brinker 2010). In 2001, the ANF partnered with Dave Brinker of the CAPG and he has led the effort to monitor and determine the success of northern goshawk territories on the ANF. In 2013, in addition to the territory status and success monitoring, CAGP piloted the video monitoring of two active nests on the Forest with the objective to obtain data on the cause of nest failure in goshawks.

Results

Central Appalachian Goshawk Project

Measures of northern goshawk population monitoring and reproductive parameters documented by the CAGP are presented in Figures 33 and 34. From 2003-2010 nesting success averaged 48% (range 17-71%) with three years below 50% and three years at 50%. All nesting territories in West Virginia and Maryland were vacated while in Pennsylvania known territories in the southern portion of the state also gradually went vacant.

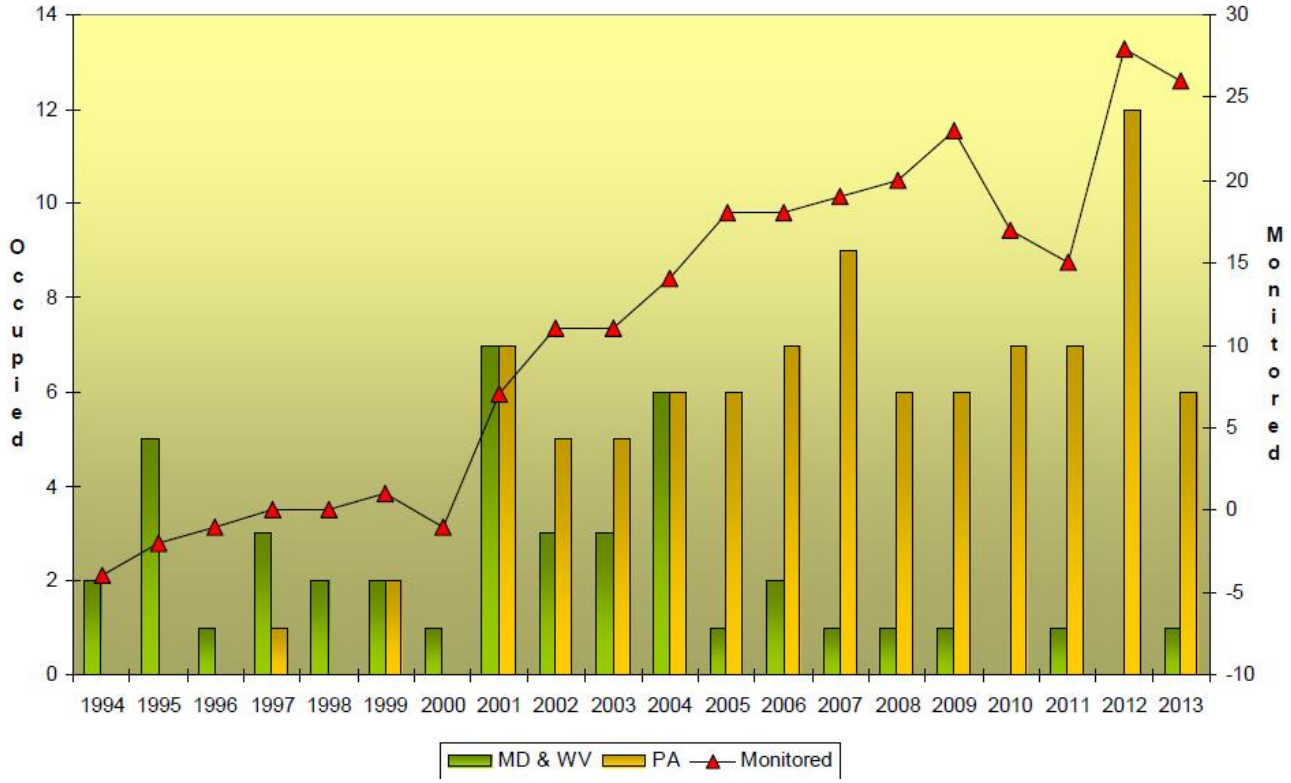

Figure 33. Northern goshawk territory distribution and monitoring as part of the Central Appalachian Goshawk Project (Brinker 2013a)

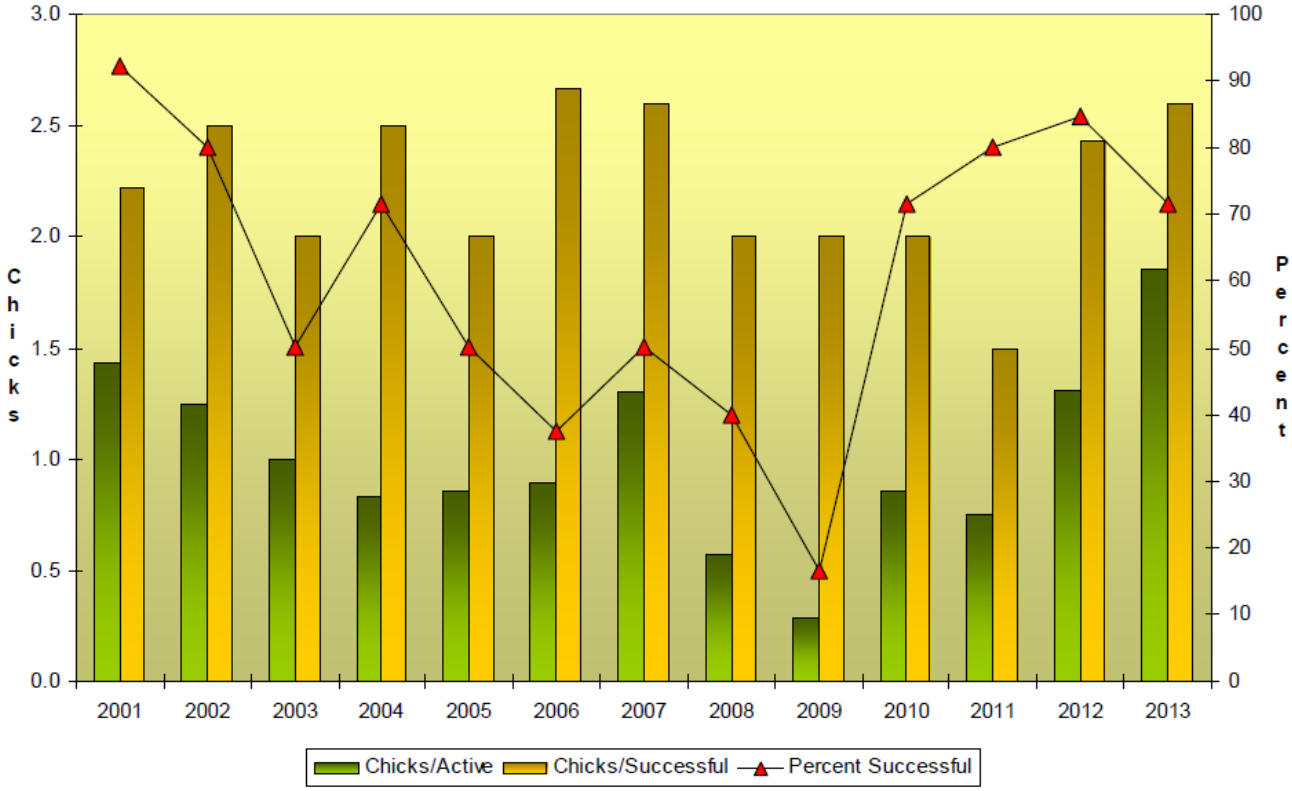

Figure 34. Northern goshawk reproductive success as monitored for the Central Appalachian Goshawk Project (Brinker 2013a)

Northern goshawks on the ANF

As part of the CAGP, known northern goshawk territories were monitored on the ANF to determine status and fledgling success (Table 7). The number of territories monitored and the number in active territories generally increased from FY 2008 through FY 2013 with a peak in FY 2012 (18 territories monitored with 11 territories active). From FY 2008 through FY 2013, 20 distinct territories were monitored with 15 territories documented as active. Of those 15 territories, eight fledged at least one young, four failed and did not successfully fledge any young, and three successfully fledged young, but the number fledged is unknown.

Table 7. Northern goshawk territories monitored, status, and fledging success (FY 2008-2013)

Fiscal Year	Territories Monitored	Active Territories (Female Incubating)	Failed Territories	Young Fledged
2008	9	3	2	1 nest fledged 1
2009	10	2	2	0
2010	12	4	1	1 nest fledged 2 2 nests number fledged unknown
2011	11	4	0	2 nests fledged 2 2 nests fledged 1
2012	18	11	1	3 nests fledged 3 2 nests fledged 2 1 nest fledged 1 4 nests number fledged unknown
2013	16	5	2	1 nest fledged 3 2 nests fledged 2[1]

[1] – One of these nests produced three northern goshawk chicks, but only two fledged as take of the third (a female) by a Pennsylvania Game Commission permitted falconer was authorized per the ANF Falconry Policy.

The two active nests included in the video monitoring pilot were successful and data on the cause of nest failure were not obtained.

Conclusions – During the period of CAGP reduced reproductive success (2003 – 2010), both Pennsylvania and New York completed their second breeding bird atlas projects and recorded declines in northern goshawks (Crocoll 2008, Brinker 2012). These declines occurred while regional habitat was relatively stable.

The exact cause of the poor reproductive success from 2003-2010 is unknown. The eight-year period of low reproductive output is the most likely factor responsible for the observed retraction of northern goshawk breeding in the Central Appalachians (Brinker 2013b). A healthy growing population from Pennsylvania northward that can serve as a source for dispersing juveniles, and most importantly sub-adults, is essential to maintaining northern goshawk breeding populations in Maryland and West Virginia. Two potential hypotheses that could explain the poor reproductive success and breeding retraction are increased nest predation and West Nile Virus related change in adult survival rates

(Brinker 2013b). Perhaps the most likely explanation is a combination of both hypotheses acting synergistically on population demographics to reduce overall population reproductive success (Brinker 2013b).

On the ANF, the northern goshawk has been considered an uncommon species. Between 1986 and 2006, 74 nests were identified Forest-wide collectively representing 43 distinct territories (USDA-FS 2007b, p. 3-196). Seven of those territories were known to be active between 1986 and 1990, 15 territories were documented as active between 1991 and 1999, and 12 territories were documented as active between 2000 and 2006. While ANF territories mirrored the reduced reproductive success exhibited in the CAGP, territory activity between FY 2008 and FY 2013 (15 territories documented as active) was comparable to historic activity levels and nest success has turned since FY 2012. This suggests northern goshawk populations on the Forest have continued to remain relatively stable over the long-term (since 1986).

Although the FY 2013 video monitoring pilot did not obtain data on the cause of nest failure, pending analysis of the abundance of data collected at the successful nests, it should provide much insight into northern goshawk behavior at active nest sites.

Management activities in occupied habitat

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Northern goshawk	What management activities have occurred within known goshawk territories and how have these altered habitat conditions?	Annual	5 Years	B

Protocol – A habitat and activity analysis was completed on the five active goshawk nests from FY 2013 using ANF GIS data. Three buffer zones were delineated around each nest location: 0 to 660 feet (31 acres), 660 to 1,320 feet (94 acres), and 1,320 to 2,640 feet (377 acres; USDA-FS 2007a, p. 88). Each buffer zone was analyzed for miles of road, miles of ATV/motorized bike trail, miles of snowmobile trail, miles of hiking trail, acres of three structural/age classes (0-20, 21-110, and 110+ years old), acres of non-forested habitat, and acres of high quality remote habitat.

Results – A summary of the habitat and activity analysis for the five northern goshawk nests active on the ANF in FY 2013 is provided in Table 8.

Table 8. Habitat and activity analysis of northern goshawk nests active in FY 2013

	Buffer		
Activity	**0-660 feet**	**660-1,320 feet**	**1,320-2,640 feet**
Roads – Miles (# Nests)	0.37 (2)	2.12 (3)	12.31 (5)
ATV/Motorized Bike Trails – Miles (# Nests)	0	0	0
Snowmobile Trails – Miles (# Nests)	0	0	0.18 (1)
Hiking Trail – Miles (# Nests)	0.24 (2)	1.08 (3)	1.37 (3)
0-20 years old – Acres	0	0	14 (2)
21-110 years old – Acres	141 (5)	391 (5)	1,436 (5)
111+ years old – Acres	0	0	26 (5)
Conifer and Mixed Conifer/Hardwood Forest Type – Acres	56 (4)	129 (4)	458 (5)
Non-forest – Acres	0	1.9 (1)	41 (4)
High quality remote habitat* – Acres	0	0	0

* see *High quality remote, interior, and late structural/old-growth habitat* section

Conclusions – In 2006, an analysis of northern goshawk habitat preferences found that known nest sites (USDA-FS 2007b):

- contained a prominent component of conifer and mixed conifer/hardwood forest;
- occurred on relatively level ground;
- contained greater amounts of mature forest and fewer openings;
- included a variety of forest types, age classes, and small openings; and
- avoided medium to high use roads, but contained a greater density of trails than is available across the landscape.

This supported the findings of an earlier habitat analysis conducted by Kimmel and Yahner (1994) and was reflected in the territory selection of northern goshawks on the ANF in FY 2013. None of the nests were within 2,640 feet of motorized trails active during the active season, but some included hiking trails. While preferred habitat is characterized by a combination of early, mid and late structural conditions, territories were located predominately within mid-structural (21-110 years old) forest.

Conifer was common within territories and non-forested openings were also present, but represented a much smaller component.

Habitat suitability modeling and field validation work was completed by Ian Gardner, a Penn State graduate student, during the 2013 field season. Analysis of the results is pending; however, this work will help the ANF and Pennsylvania Game Commission (PGC) better understand the habitat requirements for the species and their distribution across the landscape.

Relationship between trends in habitat and populations

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Northern goshawk	What is the relationship between trends in habitat and populations?	Not applicable	5 Years	B

Protocol – Compare results of *Northern goshawk – population trends, active territories, and young produced* with the habitat analysis of active nests (see *Northern goshawk – management activities within occupied habitat*).

Results – See *Northern goshawk – population trends, active territories, and young produced* and *Northern goshawk – management activities within occupied habitat*.

Conclusions – While ANF territories mirrored the reduced reproductive success exhibited in the CAGP, territory activity between FY 2008 and FY 2013 (15 territories documented as active) was comparable to historic activity levels and nest success has turned since FY 2012. This suggests northern goshawk populations on the Forest have continued to remain relatively stable over the long-term (since 1986). These trends in habitat and territory activity align with the management emphasis that was included in the Forest Plan FEIS for the species (USDA-FS 2007b, p. 3-197 – 3-198):

- Providing the habitat conditions necessary to maintain a minimum of 45 potential territories;
- Maintaining > 70% forest cover on NFS lands (see *Provide minimum percent forest cover*);
- Manage suitable goshawk habitat at the landscape level to provide desired foraging and nest site conditions;
- Protect active goshawk nests and maintain preferred structural conditions within active territories (see *Northern goshawk – management activities within occupied habitat*);
- Identify area requirements and continue to refine and identify landscape and site characteristics preferred by the northern goshawk (see *Northern goshawk – management activities within occupied habitat*); and
- Work with research and in-service and out-service partners to reduce risks from the HWA (see *Destructive insects and diseases – Hemlock woolly adelgid*).

Northern goshawk recommendations – Continue to work with Dave Brinker of the CAGP to monitor known northern goshawk territories. Review the results of Ian Gardner's habitat suitability model. Habitat analysis should continue in an effort to correlate habitat preferences and quality with nesting

activity and success. Continue to maintain the integrity of northern goshawk habitat by implementing the management emphasis outlined in the Forest Plan FEIS.

Management Indicator Species – timber rattlesnake

Population trend, active dens, population estimate, activities affecting habitat, and relationship between trends in habitat and populations

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Timber rattlesnake	What is the population trend of timber rattlesnake? How many rattlesnake dens are known to occur on the ANF? Of the known dens, how many are active and what is the number, size and sex of snakes in occupied dens? What is the estimated number of snakes using the den? What activities have affected timber rattlesnakes and their habitat? What is the relationship between trends in habitat and populations?	Annual	5 Years	B

Protocol – Potential and confirmed timber rattlesnake (*Crotalus horridus*) dens were monitored at least once a field season between April and October every year. When monitoring a den site during the spring and fall, the number of snakes observed, the sex, age, weather conditions and status of vegetation were documented when possible.

In FY 2008, the ANF and PFBC entered into a cooperative agreement to monitor timber rattlesnakes in an attempt to locate new den locations and confirm potential den sites. ANF and PFBC staff captured timber rattlesnakes in areas where no dens were known. PFBC personnel surgically implanted a radio transmitter in each captured snake and staff from both the ANF and PFBC tracked the movement of tagged snakes on a weekly basis until it was determined they were no longer migrating, which usually occurred around the second week of October. Each time a snake was tracked, a GPS location was recorded. At the beginning of subsequent field seasons, attempts were made to capture snakes near these potential den sites in hopes of documenting new dens.

Results – Radio telemetry monitoring resulted in the capture and tagging of 31 timber rattlesnakes and confirmation of 21 dens across the ANF (Table 9). The number of active den sites, both potential and confirmed, documented by monitoring ranged from two in FY 2009 to twelve in FY 2011.

Table 9. Timber rattlesnake den monitoring and PFBC telemetry program (FY 2008-2013)

Fiscal Year	Rattlesnakes Captured and Tagged	Dens Confirmed	Mortalities	Dens (Potential and Confirmed) Active	Adults Observed	Neonates (Juveniles) Observed
2008	5	2	1 – illegally poached	3	3	7
2009	3	2	1 – on ATV trail	2	3	2
2010	5	3	1 – vehicle and 1 – natural predation	4	4	2
2011	5	5	0	12	22	61
2012	6	6	0	8	7	9
2013	7	3	0	8	15	24

Radio telemetry provided information on timber rattlesnake mortality. For example, in FY 2008, one of the five snakes captured and tagged was illegally killed within 48 hours of release; however, law enforcement officials were able to recover the transmitter and issue a citation. Preliminary calculations also showed the male snakes tracked in FY 2008 traveled from 1 to 1.5 miles away from the den sites resulting in at least 2 to 3 miles of travel away from and back to their den. During a later year, a male snake was tracked 5.5 miles back to his den, totaling a roundtrip of at least 11 miles.

Conclusions – Prior to the agreement, the PFBC was in the process of visiting all historic records of timber rattlesnake dens on the ANF to document rattlesnake activity. Survey data indicated that many den sites were no longer active and rattlesnake populations were declining on the ANF. The dens that were considered active were assumed so based on documented observations of individuals, particularly neonates. While the observation of neonates is a good indication of a den, it does not serve as a conclusive identifier. Through the telemetry program, 21 dens were confirmed on the Forest, including three on the Bradford Ranger District which did not have any potential timber rattlesnake dens identified prior. Given that den sites are the focal point of rattlesnake activity and snakes show a high fidelity to their dens, this information is important for developing project mitigations and buffers to protect known dens, particularly as populations statewide are still believed to be in decline (NatureServe 2014).

The most notable affects to timber rattlesnakes come from human-snake encounters resulting in poaching, death by vehicles and habitat alterations. Habitat alterations include loss of habitat, fragmentation, and isolation of populations.

Vegetation management activities that occur on the ANF are temporary alterations of landscape structure while road construction, pit expansion, and OGD are permanent alterations and both contribute to landscape fragmentation. The resulting early successional stands from vegetation management are beneficial to timber rattlesnakes as they provide basking and foraging sites; however, adverse effects may also be realized through direct mortality.

Landscape fragmentation can have an effect on timber rattlesnake behavior, specifically during migration, but also to basking and foraging behavior. Traversing a diverse landscape has not been found to be an impediment to timber rattlesnake spring mating migration or fall when they are returning to

their den. However, some alterations or activities could cause direct mortality, e.g., where road construction increases human/snake encounter, or barriers to migrating snakes, e.g., stone pit expansion.

Timber rattlesnakes utilize a variety of habitats throughout their life; however, den sites are the limiting factor in timber rattlesnake reproduction and hibernation. When surrounding vegetation becomes too dense at a den site, the gravid females must travel further distances to bask and gestate their young. This makes them more susceptible to predation, human encounters, and vehicle mortalities. Losing one gravid female each year from a den, where numbers are already below historic numbers, could result in localized extirpation at that site. Also, if a den fails, males from other dens may have to travel further or in different directions to seek out females for mating. If they repeatedly fail to mate, populations at dens could become isolated and eventually extirpated.

Timber rattlesnake recommendations – Continue to work closely with PFBC and implant additional transmitters in adult snakes with a goal of locating new dens.

Continue participation in the Timber Rattlesnake Conservation Work Group to stay up-to-date on population status and hunting regulations. Make recommendations in regards to restricting hunting in parts of the ANF where populations are struggling.

Maintain the integrity of den sites by reducing or removing human activities that have a high risk of causing rattlesnake mortality. Consider manipulating vegetation at den sites where basking and foraging habitat has become limited.

Continue public education efforts to reduce fears and increase appreciation for this sensitive species. In an effort to educate the public about timber rattlesnakes, biologists on the Marienville Ranger District developed a rattlesnake brochure. This brochure has been distributed to various user groups and is available free of charge at all ANF offices. Educational presentations have been given to user groups such as recreational clubs, oil and gas companies, and local schools and colleges. The presentations focus on the docile nature of the timber rattlesnake, population declines, and their integral value in our ecosystems.

During the timber rattlesnake spring emergence period lasting through June, ANF staff should increase efforts to locate new dens and visit all known dens to ensure that habitat integrity is being maintained. While at the den sites, collect information such as number of adult snakes and neonates observed, and the sex of adults observed.

Management Indicator Species – aquatic invertebrates

Population trend

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Aquatic Invertebrates	What is the population trend of aquatic invertebrates?	Annual	5 Years	B

Protocol – Data were gathered from benthic macroinvertebrate surveys completed by Clarion University of Pennsylvania, the Pennsylvania Department of Environmental Protection (PADEP), and the USACE. All three utilized the EPA's Rapid Bioassessment Protocols or a modification there of.

Clarion University of Pennsylvania – potential impacts of oil and gas development

In 2008, Clarion University of Pennsylvania completed a study to assess the potential impact of OGD on aquatic macroinvertebrates on the ANF. Macroinvertebrates were collected at three seasonal intervals (early summer, late summer, and fall/winter) from 26 sites located on 18 streams on the ANF. Sampling sites were situated in areas of active OGD, in areas of little or no development, and in areas where future development was anticipated. At the same time as biological sampling, water quality parameters, including pH, conductance, alkalinity, hardness, dissolved oxygen, and temperature were measured at each site. Physical parameters, such as stream width and stream depth, were also recorded at each site.

Clarion University of Pennsylvania – Chappel Fork oil spill

Over the weekend of August 16-17, 2008, there was an intentional discharge of crude oil into Chappel Fork by disgruntled employees of an oil and gas company. Approximately 45,000 gallons were released from storage units, about half of which made it through containment facilities into Indian Fork and the lower reaches of Chappel Fork. Approximately six miles of Chappel Fork upstream from Chappel Bay and two miles of Indian Fork were contaminated with the released oil.

As part of their assessment of the potential impacts of OGD, Clarion University had established a sampling site within the area heavily polluted by the oil release. They had collected two sets of samples prior to the oil spill, on May 30 and August 5, 2008, and one set of samples following the spill on December 30, 2008.

Pennsylvania Department of Environmental Protection – Chappel Fork oil spill

In response to the Chappel Fork oil spill, PADEP conducted an aquatic biology investigation of the Chappel Fork watershed on September 16-18, 2008. The survey in part involved macroinvertebrate sampling at nine stations within the watershed on Indian Run, North Fork Chappel Fork, and Chappel Fork. PADEP also conducted a second aquatic biology investigation of the basin in September 2009.

Pennsylvania Department of Environmental Protection – Instream Comprehensive Evaluation surveys

Section 303(d) of the federal Clean Water Act (CWA) requires Pennsylvania to identify all waters within the Commonwealth whose water quality limited segments require the development of total maximum daily loads (TMDLs) to assure future compliance with water quality standards. Water quality limited segments are defined as waterbodies that do not meet water quality standards even after the application of technology-based treatment requirements to point and nonpoint sources of pollution. To investigate and determine possible sources and causes of impairment, biological, physical and chemical data are collected and analyzed.

PADEP routinely samples benthic macroinvertebrates as part these surveys and follows the Instream Comprehensive Evaluation (ICE) Surveys sampling methodology (PADEP 2013a). An Index of Biotic Integrity (IBI), used as part of the ICE surveys, measures the extent to which anthropogenic activities compromise a stream's ability to support healthy aquatic communities through direct quantification of biological attributes along a gradient of ecosystem conditions. Each of the six IBI metrics exhibits a strong ability to distinguish between relatively pristine and heavily impacted conditions. In addition,

each metric measures a different aspect of the benthic macroinvertebrate community. Taken together as the IBI multi-metric index, they provide a solid foundation for assessing the biological condition of benthic macroinvertebrate assemblages in Pennsylvania's wadeable, freestone, riffle-run stream ecosystems. An aquatic life use impairment threshold has been defined as an IBI score less than 63.

As part of a statewide effort from 2008 to 2013, PADEP collected macroinvertebrate data at 252 streams in 37 watersheds partially or entirely overlain by the ANF. These tabular data were received from PADEP in 2013.

U.S. Army Corps of Engineers – macroinvertebrate surveys on tributaries to Allegheny Reservoir

In 2006, the USACE began collecting macroinvertebrate and water quality data from streams tributary to Allegheny Reservoir. Each year they continued to sample 5-10 streams with the goal of obtaining baseline information for each of the named streams. Most have no historical data that could be used for reference should future impacts occur (e.g., Chappel Fork oil spill in 2008). A second, equally important goal is the identification of possible sources and causes of impairment from point or non-point source pollutants.

Clarion University of Pennsylvania – oil and gas development effects on similar, adjacent watersheds

In 2010, a study was conducted to compare the benthic macroinvertebrate communities in the Hedgehog Run and Grunder Run watersheds. While these two adjacent watersheds are similar in size and topography, the Hedgehog Run watershed has very little OGD and the adjacent Grunder Run watershed has extensive OGD. Monthly kick-net samples were collected from slow and fast riffles at two sites from April to October. Water quality parameters, including pH, conductivity, temperature, dissolved oxygen, alkalinity, and total hardness were also collected. Turbidity measurements were collected by U.S. Geological Survey (USGS) water gauging stations in Grunder and Hedgehog every 15 minutes from June through October.

In addition to the 2010 sampling, this study reviewed previous surveys to provide insight on the history of the trends in water quality and the macroinvertebrate community of Grunder Run.

Pennsylvania Department of Environmental Protection – Aquatic Biology Investigation

In 2013, PADEP examined 24 streams from six drainages across a variant of geologic formations to determine if they are impacted by natural acidification or acid deposition. Spring and fall macroinvertebrate surveys were conducted along with aluminum concentration sampling.

Results

Table 10. Aquatic invertebrate surveys completed on the ANF (2008-2013)

Year	Assessor (Study)	Objective	Conclusions
2008	Clarion University of Pennsylvania (Harris 2011a)	Assess potential impacts of OGD	No observable differences between populations from sites located in areas of active OGD and those of undeveloped areas
2008	Clarion University of Pennsylvania (Harris 2011a)	Assessment of oil spill in Chappel Fork	Clear detrimental impacts to the macroinvertebrate fauna of the stream
2008-2013	PADEP (Pulket pers. comm. 2013)	ICE Surveys-assess the extent to which anthropogenic activities compromise a stream's ability to support healthy aquatic communities	80% of the 252 streams sampled on the ANF are meeting or exceeding their water quality standards based on this IBI. Impairments are most frequently related to acid deposition or acidity from natural sources. Other impairments are related to the Chappel Fork oil spill or nutrient impairments.
2008-2013	USACE (Reilly pers. comm. 2014)	Macroinvertebrate surveys on tributaries to Allegheny Reservoir	No major issues detected; "most have beautiful bugs"
2010	Clarion University of Pennsylvania (Harris 2011b)	OGD effects on similar, adjacent watersheds	No significant differences in macroinvertebrate communities
2013	PADEP (PADEP 2013b)	Aquatic Biology Investigation-acidification study on 24 streams in six drainages	37.5% failed to attain threshold; 25% had episodic dissolved; aluminum >150 ppb; Six streams added or changed to Category 5 of the Integrated Water Quality Report for "Atmospheric Deposition - pH" and "Atmospheric Deposition - Metals"; Two streams listed as impaired from "natural sources".

Clarion University of Pennsylvania – potential impacts of oil and gas development

Results indicated that all sampled streams are within the bounds of water quality established by the PADEP. Results of the biological sampling suggest that differences in macroinvertebrate populations in

the sampled streams appear to be related to watershed location and stream size, with no observable differences between populations from sites located in areas of active OGD and those of undeveloped areas.

Clarion University of Pennsylvania – Chappel Fork oil spill

In terms of water quality, before and after the oil spill, there was no detectable difference in the parameters measured. However, there was a significant difference in the aquatic macroinvertebrates collected before and after the oil spill. In most streams sampled, the greatest number of individuals and taxa were collected in the early summer and fall/winter collections, but in Chappel Fork, macroinvertebrate diversity and abundance were lowest in the fall/winter collection following the oil spill.

Although the total numbers were similar to those of the late summer collections, the number of taxa was reduced from 26 to 16, with the oligochaetes being the dominant taxa following the spill. The substrate during this collection was still oily and it is not surprising that the tolerant worms were the only group prospering. A comparison of the biotic indices from before and after the spill reinforces these observations. The Shannon-Wiener Diversity was markedly decreased while the Shannon Index tripled indicating most organisms were in only a few taxa. The Hisenhoff Index increased to 7.6 following the spill, a number which is indicative of a poor aquatic ecosystem. Interestingly, the proportional composition of functional feeding groups for the site was little changed following the oil spill, although the numbers comprising each group were reduced.

When the macroinvertebrate data were clustered in terms of presence or absence a definite pattern emerged. Based on the early and late summer collections, Chappel Fork was most similar to Four Mile Run, a stream not impacted by OGD, but in the fall/winter collection Chappel Fork was separated from all other sampled streams with no similarity. In the final analysis where similarities were compared across all dates, Chappel Fork again clustered separately from all other streams.

Pennsylvania Department of Environmental Protection – Chappel Fork oil spill

The results of PADEP's 2008 investigation showed that the oil spill caused significant damage to the benthic macroinvertebrate community within approximately 2.6 miles of the North Fork, 1.4 miles of Indian Run and 2.2 miles of Chappel Fork. Macroinvertebrate mortality was extremely high and aquatic insects were found in various degrees of decomposition. This indicated that macroinvertebrate mortality was still occurring after a month from when the oil spill first occurred (PADEP 2009b).

The results of the 2009 investigation showed improvement in the benthic macroinvertebrate community. The density of aquatic insects had increased when compared to the 2008 investigation; however, scores remained below the threshold of 63.0 (PADEP 2011).

Pennsylvania Department of Environmental Protection – Instream Comprehensive Evaluation surveys

The preliminary results from this monitoring show that 80% of the 252 streams sampled on the ANF are meeting or exceeding their water quality standards based on IBI.

U.S. Army Corps of Engineers – macroinvertebrate surveys on tributaries to Allegheny Reservoir and River

The streams surveyed by the USACE from FY 2008 through FY 2013 are listed in Table 11. Analysis of the results and calculation of IBI scores is forthcoming; however, per Rose Reilly, USACE, no major issues have been detected and "most of the streams have beautiful bugs".

Table 11. U.S. Army Corps of Engineers macroinvertebrate collections from tributaries to the Allegheny Reservoir and River (FY 2008-2013)

Location	Date Sampled	Station Code
Allegheny River, Billies Run	05/22/08	2240
Brothwell Run	05/22/08	2244
Pigeon Run	05/22/08	2246
Wolf Run	05/22/08	2202
Allegheny River, Hemlock Run	05/19/09	2214
Allegheny River, Morrison Run	05/19/09	2212
Cornplanter Run	05/19/09	2260
Johnny Cake Run	05/19/09	2258
North Branch Hodge	05/19/09	2256
Campbell Run	05/20/10	2204
Dewdrop Run	05/20/10	2206
Dutchman Run	05/20/10	2210
Mud Lick Run	05/20/10	2226
South Branch Hodge Run	05/20/10	2254
Nelse Run	05/21/10	2248
North Branch Tracy Run	05/21/10	2264
Polly's Run	05/21/10	2242
Tracy Run	05/21/10	2262
Peters Run	05/17/11	2277
South Branch State Line Run	05/17/11	2270
Chappel Fork	04/04/12	2220
Kinzua Creek	04/04/12	2233
Meade Run	04/04/12	2234
South Fork Kinzua Creek	04/04/12	2231
Willow Creek	04/04/12	2268
Brothwell Run	04/05/12	2244
Pigeon Run	04/05/12	2246
Wolf Run	04/05/12	2202
Total Collections (2003-2013)	**39**	

Clarion University of Pennsylvania – oil and gas development effects on similar, adjacent watersheds

Grunder Run had generally higher overall abundance, overall taxa richness, EPT (Ephemeroptera-mayfly, Plecoptera-stonefly, and Trichopera-caddisfly) richness, EPT abundance, percent EPT, and EPT

vs. Chironomidae abundance for most months and for the year. Hedgehog Run generally had a higher percent composition of Chironomidae and Chironomidae abundance for most months and for the year. Hedgehog Run had higher Shannon-Wiener diversity index values, Shannon's Equitability values, and Simpson's Reciprocal index values for most months and for the year. The Hilsenhoff Biotic Index values for Grunder and Hedgehog Run were variable, while the Sorensen's Quotient indicated that the communities in Hedgehog and Grunder Run were similar. Functional feeding group and habitat group examinations showed slight differences between the two streams, but were inconclusive.

Comparisons to previously completed surveys indicated improvement in macroinvertebrate communities since the initial OGD in the 1980's. The overall improvement in water quality and macroinvertebrate communities from the 1980's to 2010 is likely due to the fact that most of the initial development and road construction was done in the 1980's and the community has had time to adjust and recover. Nearly all of the taxa identified in the previous surveys were collected in the 2010 survey.

For additional results from the water quality parameter and USGS turbidity measurement collections, as well as comparisons to previous surveys of Grunder Run, see *Status of water quality*.

Pennsylvania Department of Environmental Protection – Aquatic Biology Investigation

Nine streams had both spring and fall IBI scores less than the aquatic life use impairment threshold of 63.0.

See *Status of water quality* for additional results from the aluminum concentration sampling conducted.

Conclusions

Clarion University of Pennsylvania – oil and gas development

The Clarion University studies did not detect substantial differences between the macroinvertebrate communities of streams within watersheds with differing levels of OGD. This may be a result of an insufficient number of collections. Likewise, sampling was not of long enough duration to detect changes within individual streams. Each of the Clarion studies took place over a single season. Changes to macroinvertebrate communities are cumulative in nature, and only become evident after several years of collecting. As an example, sedimentation in the streams within development areas may reach a threshold after which aquatic fauna decreases rapidly. It may be that they simply have not reached that threshold as yet.

Another possible explanation for a lack of detectable difference in benthic fauna may be related to sampling localities in the streams. Samples were taken within fast riffles and slower riffle/glides which are located in higher gradient portions of the streams. Since the majority of streams on the ANF are high gradient, sediment may have been rapidly flushed through the streams during periods of high water. Had pools and lower gradient portions of the streams, where sediment is more likely to be deposited, been included the studies they may have detected more of a difference in faunal composition. Although sampling in pools is typically more qualitative than that in riffles and glides, it should be considered in any additional follow-up study.

While sampling efforts did not detect faunal differences related to OGD, the impact of the August 2008 oil spill in Chappel Fork was clear. Based on the early and late summer collections, Chappel Fork was

most similar to Four Mile Run, a stream not impacted by OGD, and Morrison Run; however, based on fall/winter collections, Chappel Fork separated out from all other sampled streams with no similarity, indicating the oil spill impacted the macroinvertebrate fauna of the stream. The spill's immediate impact on benthic communities was also reflected in PADEP's 2008 macroinvertebrate sampling within the Chappel Fork watershed; however, 2009 surveys concluded that while the benthic communities were still impacted a year after the oil spill, recovery was occurring.

Pennsylvania Department of Environmental Protection – Instream Comprehensive Evaluation surveys

The preliminary results from this monitoring showed that 80% of the 252 streams sampled on the ANF are clearly meeting or exceeding their water quality standards based on the IBI (> 63) for the determined water use. While the other 50 streams may have not met the IBI threshold during one sampling period, they will not all be listed as impaired by PADEP if they only have one sampling period that falls below the IBI standard. Per PADEP, aquatic life use impairment occurs when aquatic life appears to be depressed in a stream year round.

Sites that fell below the attainment IBI score are most frequently depressed due to acid deposition (see *Status of water quality*). Many of these sites fall below the IBI threshold in the spring due to snowmelt and acidic storm flow, but then improve later in the year during baseflow when groundwater improves water quality. Other streams not attaining IBI scores are related to point sources such as the Chappel Fork oil spill or nutrient impairments from sewage discharge to streams.

Pennsylvania Department of Environmental Protection – Aquatic Biology Investigation

In nine of the 24 streams sampled, impacts from acid deposition were evidenced by year-round IBI scores less than the aquatic life use impairment threshold of 63.0. Of those nine, six had dissolved aluminum concentrations greater than 150 ppb during spring snow melts and rain events indicating acidification is from precipitation, not due to natural conditions (see *Status of water quality*).

Diversity and relative abundance

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Aquatic Invertebrates	Is aquatic invertebrate diversity and relative abundance being sustained on the ANF?	Annual	5 Years	B

Protocol – Using the data that were collected for *Aquatic invertebrates – population trends*, an assessment was made of aquatic invertebrate diversity and relative abundance on the ANF.

Results – See *Aquatic invertebrates – population trends*.

Conclusions – Aquatic invertebrate diversity and relative abundance on the ANF is being sustained on the majority of the ANF.

Relationship between trends in habitat and populations

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Aquatic Invertebrates	What is the relationship between trends in habitat and populations?	Annual	5 Years	B

Protocol – Using the data that was collected for *Aquatic invertebrates – population trends* and habitat data collected by the PADEP during Instream Comprehensive Evaluation surveys, an assessment was made of the relationship between trends in habitat and populations.

Twelve habitat parameters, including four riparian parameters – Condition of Banks, Bank Vegetation, Disruptive Pressure and Riparian Zone – and eight instream parameters – Instream Cover, Epifaunal Substrate, Embeddedness, Sediment Deposition, Frequency of Riffles, Channel Sinuosity, Channel flow Status and Channel Alteration – were given a score ranging from 0 to 20. The Total Habitat Score is computed from the scoring of the 12 habitat parameters.

Results – For the 252 streams surveyed on the ANF, 87% had optimal habitat conditions and 13% had suboptimal conditions (Pulket pers. comm. 2013). There were no streams that were rated as marginal or poor.

A review of the Elk County Conservation District (ECCD) and PADEP assessments of 17 sites in Elk County (see *Status of water quality*) found that 14 sites were optimal and 3 sites (Three Mile Run, Crooked Run, and Little Otter Run) were suboptimal (Bonfardine 2014).

Conclusions – Overall physical habitat scores were slightly better than overall IBI scores for macroinvertebrates indicating that aquatic habitat is not the limiting factor in streams. Water quality is more limiting for macroinvertebrates in numerous streams due to low pH and alkalinity (see *Status of water quality*).

The main issue for the slightly lower habitat scores at Three Mile Run, Crooked Run, and Little Otter Run in Elk County were low scores in embeddedness and sediment deposition. This sedimentation is likely related to roads depositing silt and sediment in streams.

Aquatic invertebrate recommendations – PADEP recommends that future acid deposition projects and funding should be focused on treatment of the six streams revealed not to be in attainment of their designated aquatic life use during the Aquatic Biology Investigation study. Alkalinity is nearly or completely absent in the majority of these six streams. Assuming proper construction, maintenance, and operation, passive treatment systems could raise alkalinity and pH in these streams, leaving them less susceptible to dissolved aluminum toxicity. The remaining streams examined during this study should continue to be monitored, particularly in the fall, to document possible degradation of macroinvertebrate assemblages and other aquatic life.

Clarion University of Pennsylvania recommends the sampling of macroinvertebrates in pools if additional surveys are conducted as follow-up to their assessments of OGD, and PADEP

recommends resurvey of the Chappel Fork watershed macroinvertebrate community is completed until full recovery is documented.

USACE recommends the sampling of tributaries to the Allegheny Reservoir and Allegheny River should continue.

Overall, macroinvertebrate surveys should continue as they can provide an early warning of hazardous changes in water quality, detect episodic events such as pollution spills, evaluate recovery from disturbed conditions, and reveal trends and cycles. It is also recommended that the ANF inventory watersheds identified with sediment sources and apply or improve best management practices (BMPs) at the areas of concern. The ANF should continue surveying roads for sediment contributions to water ways so that these sediment sources can be mitigated. Additionally, habitat improvement projects should be focused on projects where water quality is suitable for aquatic organisms.

Management Indicator Species – mourning warbler

Population trend, locations, and population estimate

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Mourning warbler	What is the population trend of mourning warbler? Where has this species been documented? What is the ANF population estimate?	Annual	5 Years 3 Years	B

Protocol – Document mourning warbler (*Oporornis philadelphia*) occurrence during songbird survey drive routes and survey suitable nesting habitat using tape playback calls. Also, review the Second Atlas of Breeding Birds in Pennsylvania (Wilson et al. 2013). The Pennsylvania Breeding Bird Atlas provides species distribution maps that reflect the breeding bird behavior categorized by breeding evidence observed during surveys.

Annual songbird survey drive routes were chosen so that a variety of habitats were traversed. Routes were completed between dawn and 0930 with stops made every ½ mile. All singing birds were documented for five minutes. The number of routes completed varied from year to year.

Callback surveys were conducted during Pennsylvania Breeding Bird Safe Dates (June 15 – July 31) between dawn and 0930. Survey points were approximately 300 meters apart. The call was played for 60 seconds and the surveyor then listened for 90 seconds before playing the call for another 60 seconds and then moving on to the next survey point. All mourning warblers observed were documented.

In addition to the songbird surveys conducted by ANF staff, NRS staff have documented mourning warbler using audible point counts or mist netting.

Results – Table 12 documents mourning warbler observations from FY 2008 through FY 2013.

Table 12. Mourning warbler observations (FY 2008-2013)

Year	Individuals Observed
2008	0
2009	0
2010	0
2011	14
2012	8
2013	0

The possible, probable, and confirmed breeding behavior by mourning warblers documented state-wide increased by 156%, 43%, and 51%, respectively between the first breeding bird atlas (1983-1989) and the second (2004-2009; Figure 35). This represented an 83% increase overall across the three status categories.

Mourning Warbler (number of blocks)

Status	first Atlas 1983 - 1989	second Atlas 2004 - 2009	Change %
Possible	81	207	156
Probable	109	156	43
Confirmed	45	68	51
Total	235	431	83

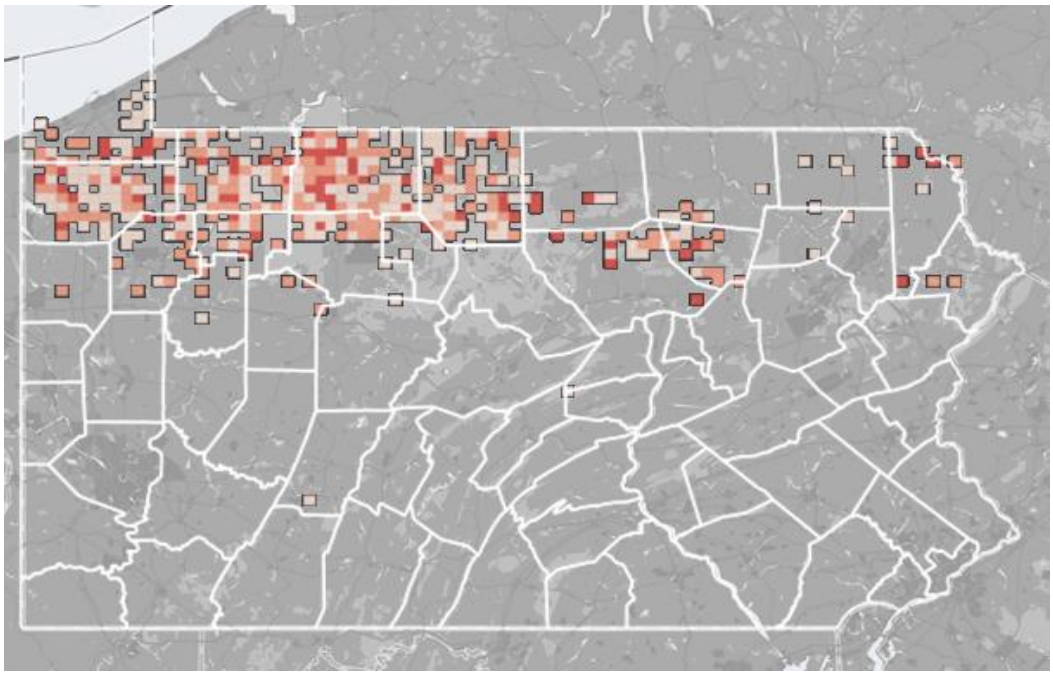

Figure 35. Pennsylvania-wide breeding status of mourning warblers from the Second Atlas of Breeding Birds in Pennsylvania

Conclusions – Based on documented occurrences from songbird routes, callback surveys, and NRS research projects, the population of mourning warblers appears to be decreasing on the ANF; however, this is in sharp contrast to the second Pennsylvania Breeding Bird Atlas statewide results and could be an artifact of low survey effort on the ANF.

Suitable habitat and activities affecting suitable habitat

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Mourning warbler	How have activities affected suitable habitat? How many acres of suitable habitat exist?	Annual	3 Years	B

Protocol – Suitable habitat on the ANF was summarized using vegetation data in the FS Veg database and activities implemented affecting suitable habitat between FY 2008 and FY 2013 were compiled from the FACTS database.

Mourning warbler suitable habitat includes early structural (0 – 20 years old) forest (USDA-FS 2007b, p. 3-203).

Results – From FY 2008 through FY 2013, 2,711 acres of overstory removals were implemented across the ANF. Currently there is 17,753 acres of suitable habitat, i.e., early structural (0 – 20 years old) forest, on the ANF (3.4% of forest land).

Conclusions – Suitable habitat on the ANF has not been maintained and is down from 36,700 acres (8% of forest land) since the start of 2007 Forest Plan implementation, representing a 49% loss of suitable mourning warbler habitat.

Relationship between trends in habitat and populations

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Mourning warbler	What is the relationship between trends in habitat and populations?	Not applicable	5 Years	B

Protocol – Compare results of *Mourning warbler – population trends, locations, and population estimate* with the current condition of suitable habitat (see *Mourning warbler – suitable habitat and activities affecting suitable habitat*).

Results – See *Mourning warbler – population trends, locations, and population estimate* and *Mourning warbler – suitable habitat and activities affecting suitable habitat*.

Conclusions – Suitable habitat on the ANF has been reduced by 49% since the start of 2007 Forest Plan implementation. Also, based on documented occurrences from songbird routes, callback surveys, and

NRS research projects, the population of mourning warblers appears to be decreasing on the ANF; however, this is in sharp contrast to the second Pennsylvania Breeding Bird Atlas statewide results and could be an artifact of low survey effort.

Mourning warbler recommendations – Continue to survey mourning warbler suitable habitat during songbird survey routes. Restore some of the lost mourning warbler habitat by implementing the management emphasis outlined in the Forest Plan FEIS to address the species (USDA-FS 2007b, p. 3-203):

- Maintain a minimum of 5% of the Forest in early successional forest and shrub habitat capable of supporting mourning warblers;
- Increase monitoring of shrub nesting birds, with emphasis along utility corridors and in areas managed through timber harvest.
- Maintain or improve the distribution of non-forested shrub habitat.

Effects to lands and communities adjacent to or near the National Forest and effects to the ANF from land managed by government entities

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Effects to lands and communities adjacent to or near the National Forest and effects to the ANF from land managed by government entities (36 CFR 219.7(f))	What are the economic effects of National Forest management actions to lands and forests near the National Forest and what effects to National Forest lands occur from land managed by other government entities?	Annual for payments; 5 years for other items	5 years	B

Protocol – A variety of data sources were reviewed in order to address effects to lands and communities adjacent to or near the ANF. Payments to local counties were compiled from All Service Receipts (ASR) databases. Timber volume and value sold and harvested was compiled from the TIM database. Estimates on timber purchasers and logging crews working on the ANF were compiled by timber program managers and sale administration staff. Stewardship contracting figures were compiled from TIM and FACTS databases. Service, construction, and supply contract information was compiled from the Federal Procurement Data System database. Partnership and agreement information for the ANF was compiled from the I-Web Grants and Agreements database. Special use permit records, including special use permits for outfitter guides and recreation events, are recorded in the Special Use Database System. A brief summary of special use and recreation events that occurred on the ANF between FY 2008 and FY 2013 was compiled through consultation with staff that manage the ANF special use program.

Results

Payments to local governments

In addition to the direct value of timber harvested, the four counties within which the ANF lies also receive payments as a portion of total receipts generated by the ANF, or through secure payments authorized by Congress. Under the 25 % Fund Payment option, local counties can elect to receive 25% of total receipts (all program areas, including timber) generated on the ANF based on a rolling seven-year average to be used for school districts and townships. Alternatively, counties may elect to receive secure payments, with 85% to be distributed to school districts and townships, 8% to be used for authorized Title II projects (protection, restoration, and enhancement of fish and wildlife habitat, and other resource objectives, as decided by a Resource Advisory Committee), and 7% are retained at the county level for community wildfire protection plans and emergency services performed by counties on federal land. Table 13 below displays payments made by the United States Treasury to local counties between FY 2008 and FY 2013, using either option.

Table 13. Payments to local counties (25% Fund Payments and secure payments; FY 2008-2013)

Fiscal Year	Elk	Forest	McKean	Warren	Total
2008	$1,002,837	$1,246,419*	$1,213,548	$1,537,560*	$5,000,364
2009	$951,774	$1,121,777*	$1,151,759	$1,383,805	$4,609,115
2010	$871,595	$1,010,984*	$1,054,737	$1,247,132	$4,184,448
2011	$798,233	$1,001,050*	$965,966	$742,998	$3,508,247
2012	$646,485	$1,052,009*	$782,340	$849,807	$3,330,641
2013	$531,397	$993,503*	$643,069	$698,644	$2,866,613
Total	**$4,802,321**	**$6,425,742**	**$5,811,419**	**$6,459,946**	**$23,499,428**

*Note: Indicates where a county elected to take secure payments as opposed to the 25% Fund Payment
Source: USDA Forest Service Secure Rural Schools Website (http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6BdkOyoCAPkATlA!/?ss=119985&navtype=BROWSEBYSUBJECT&cid=null&navid=101130000000000&pnavid=101000000000000&position=BROWSEBYSUBJECT&ttype=main&pname=Secure%20Rural%20Schools-%20Payments%20and%20Receipts) accessed 6/9/14.

Payments to local counties, either through the 25% Percent Fund or secure payments, have been declining since FY 2008. There are a number of reasons for this, including overall timber value harvested from the ANF, trends in other program areas that generate receipts on the ANF, and complexities with how secure payments are calculated. Secure payments are also declining as mandated by the Secure Rural Schools and Community Self-Determination Act. FY 2012 and FY 2013 secure payments were both based on one-year extensions of the Act which also included language in them to reduce the amount by 5% every year.

Value of timber sold

Timber from the ANF has substantial economic value and contributes to local and regional economies. The volume awarded (sold) between FY 2008 and FY 2013 had a total value of $45.62 million, averaging $7.60 million annually (Table 14). During this timeframe, timber sold in FY 2009 had the lowest total value at $5.94 million and timber sold in FY 2010 had the highest total value at $10.03 million. Prior to FY 2008, the value of timber sold on the ANF was substantially higher, totaling $116.34 million for the six year period between FY 2002 and FY 2007. This equates to an average of $19.56 million annually during this timeframe, more than double current annual amounts. Both worldwide and locally, timber markets experienced a dramatic downturn in 2008, and the overall value

of timber sold on the ANF has not recovered to pre-2008 levels though values regionally are slowly improving. For trends in stumpage and mill prices, see the current and archived Pennsylvania Woodland's Timber Market Reports (http://extension.psu.edu/natural-resources/forests/timber-market-report).

Table 14. Timber volume and value sold (FY 2008-2013)

Fiscal Year	Volume (CCF)	Value
2008	28,700	$6,854,851
2009	43,375	$5,943,811
2010	63,667	$10,030,565
2011	64,931	$7,805,735
2012	57,751	$7,179,160
2013	53,675	$7,804,060
Total	**312,129**	**$45,618,182**

Many factors influence the overall value of the volume offered, including timber markets, demand for timber products, species, overall quality, amount of sawtimber, and size classes of timber being sold. Partial harvests such as intermediate thinnings and shelterwood seed cuts tend to remove more trees in the smaller size classes, resulting in less overall value. Conversely, final harvests result in the removal of most of the trees in the stand, and typically include the largest and highest value trees.

Value of timber harvested

A number of local and regional jobs are directly and indirectly supported by the timber that is harvested to meet vegetation management objectives on the ANF. These include jobs associated with the harvest, skidding, hauling, and milling of timber; secondary timber processing industries; and reforestation and timber stand improvement services. Table 15 displays the volume and value of timber harvested from the ANF between FY 2008 and FY 2013.

Table 15. Timber volume and value harvested (FY 2008-2013)

Fiscal Year	Volume (CCF)	Value
2008	37,711	$12,907,645
2009	29,099	$5,035,091
2010	36,019	$5,881,184
2011	48,328	$7,765,532
2012	50,550	$6,946,876
2013	61,396	$8,157,973
Total	**263,103**	**$46,694,301**

The ANF averages 20-25 individual companies that purchase timber sales on the Forest. These companies generally have 1-4 operating logging crews, with 1-3 log trucks per company. Of the 25 total companies that purchase timber on the ANF, three are classed as large business, and the remainder is classified as small business by the Small Business Administration. Small business set-aside timber sales comprised over $5 million of the value of timber sold on the ANF in FY 2012 and FY 2013. Receipts generated by the harvest of timber from the ANF contribute towards Forest Service payments to local government to support public schools and roads (see following section).

Stewardship contracting

Stewardship contracting and agreements involve the exchange of goods (normally timber; Figure 36) for services (a variety of service items ranging from site preparation and aquatic organism passage installation to wildlife habitat enhancements and recreation facility improvements). Stewardship contracting helps the ANF achieve land management goals while meeting local and rural community needs, including contributing to the sustainability of rural communities and providing a continued source of local income and employment.

Figure 36. Harvest operations (removal of goods)

The intent of stewardship contracting is to accomplish resource management with a focus on restoration and benefits to local communities. Stewardship contract bidders that incorporate plans to hire local employees and service contractors in their proposals are given preference for contract award. The ANF has been using stewardship contracting authorities since FY 2009 to accelerate accomplishment of forest restoration activities through either stewardship contracts or agreements.

Stewardship accomplishments include:

- Exchanged approximately $10.1 million in goods for services between FY 2010 and FY 2013. This includes $4 million in service work and $4.3 million in retained receipts (where the value of the goods was greater than the value of the service work) for future service work.
- Awarded 23 Integrated Timber Sale Contracts and one Integrated Resource Service Contract and entered into two Stewardship Agreements.
- Expanded capacity to complete restoration work that would otherwise not be accomplished with appropriated dollars, including:
    - Chainsaw site preparation
    - Wildlife opening restoration (disk, seed and lime/fertilize; Figure 37)
    - Aquatic passage (culvert) improvements

- Road resurfacing (limestone application)
- Road realignment
- Road decommissioning
- Apple tree pruning
- Fence removal

Figure 37. Wildlife opening restoration as part of Stewardship Agreement

Service, construction, and supply contracts

The ANF annually enters into a variety of service, construction, and supply contracts to obtain services or construction products from outside vendors and companies. In many cases, these are local vendors and companies that benefit from the procurement of these goods or services on the National Forest. Table 16 summaries total contract expenditures that the ANF procured between FY 2008 and FY 2013. The majority of contract actions and expenditures made through contracts are to small businesses. The amount of work contracted varies from year to year depending on project needs and appropriations. In FY 2010, the ANF implemented about $4.3 million in contract actions to implement projects authorized under the American Recovery and Reinvestment Act (ARRA), in addition to around $3.3 million in regular appropriations.

Table 16. Summary of contract obligations (FY 2008-2013)

		Percent Value				
Fiscal Year	**Total Contract Expenditures**	**Small Business[1]**	**Women-Owned Small Business[1]**	**Veteran-Owned Small Business[1]**	**Service-Disabled Veteran Owned Small Business[1]**	**Minority Owned[1]**
2008	$ 1,728,840	75%	33%	34%	13%	36%
2009	$3,978,575	82%	33%	16%	12%	34%
2010	$7,719,616[2]	99%	20%	11%	9%	27%
2011	$2,419,810	90%	8%	9%	6%	7%
2012	$2,137,742	90%	13%	8%	4%	7%
2013	$ 1,934,653	91%	10%	14%	13%	14%
Total	**$19,919,236**	**91%**	**21%**	**14%**	**9%**	**23%**

[1]Percentages are not additive, i.e., a business may fall within more than one category.
[2]Includes expenditures and additional appropriations associated with the American Recovery Reinvestment Act (ARRA)

Partnerships

The value and benefit of a number of ANF programs are compounded by the added value (including financial, in-kind, and noncash contributions) of partnerships with various external partners. The ANF has active partnerships and agreements with universities, local counties, local municipalities, state agencies, law enforcement agencies, national conservation organizations, and more. Table 17 summarizes the number and value of partnerships implemented or modified on the ANF between FY 2008 and FY 2013. Partnerships have enhanced the value of Forest Service appropriated funding by an additional 50% and have resulted in over $11 million in accomplishments occurring with partners on the ANF.

Table 17. Summary of partnerships (FY 2008-2013)

Fiscal Year	Partnerships	Value of Forest Service Cost	Value of Partner Contributions	Total Value
2008	56	$406,722	$370,289	$777,011
2009	63	$1,990,007	$866,137	$2,856,144
2010	69	$3,688,842	$1,498,490	$5,187,332
2011	46	$158,507	$316,289	$474,796
2012	46	$751,240	$361,979	$1,113,219
2013	72	$332,256	$326,786	$659,042
Total	**352**	**$7,327,574**	**$3,739,970**	**$11,067,544**

Special use permits

Special use permits on the ANF authorize a number of different activities to occur on NFS lands or facilities.

Outfitter guide permits allow private individuals and businesses to provided outfitted or guided services for paying members of the public on NFS lands or other features administered by the Forest Service, such as Wild and Scenic Rivers. The ANF currently has 12 small businesses that hold outfitter-guide special use permits for providing services to recreating members of the public. Eight of these businesses provide canoe rental, launch, and shuttle services; two provide horseback riding tours and rentals; and two provide guided hunting and fishing services.

Developed recreation facilities on the ANF are managed through concessionaire permits. One permit holder manages developed campgrounds and boat launches on the ANF, employing approximately 50 employees during the summer months. A second permit holder manages a Forest Service marina on the Allegheny Reservoir, employing over 20 employees during the summer months. Gross revenue for these two permit holders exceeds $1.5 million annually.

Special use authorizations are used for a number of recreation events including foot races, triathlons, cross country races, bicycle races, ATV runs, organized horseback rides, snowmobile club rides, dogsled races, fishing tournaments, veterans' pheasant hunts, canoe regattas, and firefly viewing festivals. The ANF currently has over 35 active special use permits for recreation events on the Forest. These events vary in the amount of participation that they garner, and estimating local economic benefits is challenging. However, it can be concluded that recreation special events benefit local economies through the purchase of goods and services by participants while they are on the ANF. The larger notable events include the Marienville Volunteer Fire Company Tour de Forest (ATV ride) that has up to 1,000 participants, the YMCA Kinzua Tango that has an estimated 1,000 participants/spectators, and the Warren County Winterfest at Chapman State Park that includes dog sled races on the ANF and draws several thousand participants.

Conclusions – Management activities in a variety of resource program areas on the ANF have substantial economic value, thus benefiting local and regional communities. Timber sales sold on the ANF to implement vegetation management objectives generate employment opportunities and revenues for local governments. Newer timber sale contracting and acquisition tools, such as stewardship contracting, place specific emphasis on benefiting local communities and contributing to the sustainability of rural communities. Service and construction contracts to complete resource activities benefit local and regional businesses of many sizes, predominantly those classed as small businesses. The benefit and value of ANF funded programs are compounded through the use of agreements and partnerships. Small outfitter guide companies that utilize ANF facilities, or larger companies that provide recreation services, such as camping or marina facilities, hire local workforces to conduct their business on the ANF. A number of recreation special events bring visitors to the ANF, benefitting local economies.

In addition, land managed by other government agencies such as PADCNR, PGC, and USACE complements land management on the ANF.

Recommendations – Continue monitoring local and regional economic trends as well as ANF economic benefits to local communities and local and rural economies. In addition, further coordination with local governments to acquire and discuss socioeconomic data and trends will help the ANF assess its contribution toward this monitoring item.

Comparison of projected and actual outputs and services

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Comparison of projected and actual outputs and services (36CFR 219.12(k)(1))	How do actual outputs and services compare to those projected?	Annual	Annual	A

Protocol – A listing of the outputs and services projected by the Forest Plan are found in Tables 2 and 3 under the Estimated Forest Activities section within Part 2 – Strategy of the Forest Plan (USDA-FS 2007a; pp. 21 – 23). To facilitate a comparison on the progress toward these activities, the tables that follow display the same activities by resource area with the average annual projected level for the first decade and the FY 2008 – FY 2013 actual accomplishment.

The activities shown in Tables 2 and 3 are not Forest Plan decisions and should not be confused with Forest Plan objectives. These estimates are neither minimums nor limitations. They are the result of prescriptions applied in the SPECTRUM model or amounts projected by ANF resource specialists that move the current conditions toward the desired conditions described in the Forest Plan. The actual treatment level for FY 2008 – FY 2013 reflects the rate of movement toward the desired conditions. For some new activities, it may take several years for site-specific project planning to be completed and then build up toward the level of activity projected in the Forest Plan.

The Allowable Sale Quantity (ASQ) in Table 4 (USDA-FS 2007a, p. 24) is a Forest Plan decision and represents the maximum amount of timber that can be harvested from ANF lands suitable for timber production. Although the ASQ is identified as an annual average quantity for each decade of the plan, the amount produced in any one year may be either below or above the identified ASQ as long as the totals for the decade are not exceeded.

Results, Conclusion, and Recommendations by Resource Area

Recreation activities

Motorized trail construction – The ANF utilizes user-generated funds for reconstruction of approximately three miles of the off-highway vehicle (OHV) trails on the ANF annually (Table 18). In addition to the work on the OHV trail system, since FY 2010, the ANF has utilized remaining snowmobile grooming funds to work with the five local snowmobile clubs to improve the 370 mile snowmobile trail system. As a result, approximately $60,000 of PADCNR grant money has been used to improve approximately 70 miles of the snowmobile trails. Also, two miles of the Timberline ATV trail were rerouted utilizing the Forest's construction and maintenance crew in FY 2012 to protect timber rattle snake habitat. This was funded through a $120,000 PADCNR grant.

Non-motorized trail construction – Thirty-eight miles of the Spring Creek horse trail were constructed in FY 2012 and FY 2013 in Forest and Elk Counties. This work was completed utilizing $1.5 million of ARRA funding. The ANF also worked the Pennsylvania Equine Council (PEC) on signing of the horse trail along with the PADCNR to complete the signing of the trail.

Utilizing approximately $820,000 of ARRA funds, the ANF has been able to work with the Student Conservation Association (SCA) to improve approximately 96 miles of the North Country National Scenic Trail.

Dispersed site enhancement in Concentrated Use Areas (CUAs) – Dispersed sites along the Clarion River from Millstone Creek to Irwin Run received work in FY 2008 to reduce resource damage. User-developed sites were reduced from 46 to 26 and hardening parking areas has protected the recreation resource from the impact of overuse. Regular law enforcement patrols ensure camping occurs in designated areas.

In the Kelly Pines dispersed area, maintenance projects were accomplished through a partnership with volunteers from the Fayette County Chapter of the PEC. Projects in the camping area included work such as cleaning of tie stalls, roofs, restrooms, and fire rings, refreshing stall bedding, and mowing, removing brush, and trimming and falling of hazard trees.

Wilderness Areas managed to standard – In order to meet this goal, the 10-Year Wilderness Stewardship Challenge was developed by the Chief's Wilderness Advisory Group (WAG) as a quantifiable measurement of the Forest Service's success in wilderness stewardship. The goal identified by the WAG, and endorsed by the Chief, is to bring each and every wilderness under Forest Service management to a minimum stewardship level by the 50th Anniversary of the Wilderness Act in 2014. The first year of the Challenge was FY 2005. Both wilderness areas on the ANF are being managed to meet the minimum standards set forth in the Challenge (see *Manage wilderness areas to meet Wilderness Stewardship Challenge*).

Table 18. Comparison of projected recreation activities (USDA-FS 2007a, p. 21-22) to actual accomplishments (FY 2008-2013)

Management Activity	Average Annual Projected Level (Decade One)	Total Actual Accomplishment	Annual Actual Accomplishment (Average)
Motorized Trail Construction (Miles)	4	87	17.4
Non-motorized Trail Construction (Miles)	5	134	26.8
Dispersed Site Enhancement in CUAs+ (Each)	1	26	5.2
Construction/Reconstruction of Developed Facilities (Each)	2	3	0.6
Wilderness Areas Managed to Standard (Each)	4*	2	2

\+ Concentrated Use Area (CUA)

* The Allegheny only contains two congressionally designated wilderness areas that are subject to this management activity.

Prescribed burning by resource objective

Prescribed burning activities include acres treated to support forest regeneration (Figure 38), to support wildlife improvements, and to reduce hazardous fuels (Table 19).

Table 19. Comparison of projected prescribed burning activities (USDA-FS 2007a, p. 22) to actual accomplishments (FY 2008-2013) by resource objective

Management Activity	Average Annual Projected Level (Decade One)	Total Actual Accomplishment	Annual Actual Accomplishment (Average)
Prescribed Burning by Resource Objective (Acres)			
Silviculture/Reforestation	104	669	111.5
Wildlife	300	303.1	50.5
Hazardous Fuels Reduction	250	972.1	162

Figure 38. Prescribed oak understory burn near Jakes Rocks

The ANF is planning for larger landscape prescribed burns to better utilize limited resources and funding to capture the limited weather burn windows that occur in northwest Pennsylvania.

Reforestation activities

Reforestation activities include scarification for oak, release for species diversity, site preparation, pre-commercial thinning, fencing, fertilization, and herbicide treatment for reforestation (Table 20).

Table 20. Comparison of projected reforestation activities (USDA-FS 2007a, p. 22) to actual accomplishments (FY 2008-2013)

Management Activity	Average Annual Projected Level (Decade One)	Total Actual Accomplishment	Annual Actual Accomplishment (Average)
Scarification for Oak	104	0	0
Release for Species Diversity	1,727	2,925	487.5
Site Preparation	1,992	11,164	1,860.7
Pre-commercial Thinning	80	30	5
Fencing	1,701	268	44.7
Fertilization	215	0	0
Herbicide Treatment for Reforestation	2,368	5,404	900.7

Release for species diversity – Release treatments occur in young forested areas in order to maintain competitiveness of desirable tree seedlings and enhance species diversity in the future forest. The number of acres receiving release treatments is lower than that projected in the Forest Plan primarily because less final harvesting occurred in the past six years than projected in the Forest Plan.

Site preparation – Site preparation consists of non-commercial felling of small trees so sunlight reaching the forest floor is increased and tree seedlings can become established. Approximately 93% of the annual acreage projected for site preparation in the Forest Plan was treated between FY 2008 and FY 2013. This includes pre-harvest site preparation treatments in stands considered less than fully stocked in order to promote tree seedling establishment more quickly without an interim shelterwood seed cut.

Pre-commercial thinning – Pre-commercial thinning removes trees in a stand that are not old enough for a commercial treatment in order to control species composition, maintain stand diversity, improve stand quality, and to increase growth rates on preferred trees. Trees are left on site where they are felled. The acreage treated with pre-commercial thinning is lower than that projected in the Forest Plan. In most cases, the benefits to stand composition and quality can be achieved commercially once young stands have reached commercial treatment size.

Planting – The ANF experienced very good success in reforesting areas with natural seedling regeneration (see *Stocking within five years of regeneration harvest*). Fill-in, or supplemental planting, was conducted on 175 acres of the ANF between FY 2008 and FY 2013 (average of 29 acres annually). These areas were planted primarily to restock areas damaged by catastrophic wind damage that occurred in June 2003, or to supplement natural seedling abundance and diversity. Species planted included white oak, chestnut oak, red oak, cucumber-tree, tulip poplar, and eastern white pine. Survival of planted seedlings is monitored in the first and third year following planting.

Fencing – Fencing has been used for a number of decades on the ANF to protect tree seedlings from deer browsing impacts. Personnel closely monitor the need to use area fencing to reduce deer browsing impacts and decide to fence areas only after it has been determined deer browsing impacts are causing insufficient seedling numbers or species diversity to develop on specific sites of the Forest. The average annual amount of areas fenced is substantially below Forest Plan projections. Forest Plan projections for the use of fencing were based on full Forest Plan implementation at 2005 deer population levels. In 2005, the average deer density was estimated to be 26.6 deer per square mile. Since 2005, average deer densities have dropped to an estimated 13.7 deer/mi^2 on the Kinzua Quality Deer Cooperative (KQDC) and 17.3 deer/mi^2 outside of the KQDC (see *Manage white-tailed deer populations*). Additionally, regeneration harvesting that occurred between FY 2008 and FY 2013 is less than that projected for Forest Plan implementation (Table 23). As a result, the need to fence has greatly declined.

Fertilization – Fertilizer to promote rapid seedling growth was not applied between FY 2008 and FY 2013. This is because of the decline in deer populations in most areas reduced the need to apply fertilizer.

Herbicide treatment for reforestation – Approximately 38% of the annual acreage projected for herbicide application in the Forest Plan was treated between FY 2008 and FY 2013. This is most likely due to the lower amount of shelterwood seed cutting and regeneration harvesting (both even-aged and uneven-aged) during first six years of Forest Plan implementation.

Fuels, NNIS, wildlife, fish and stream activities

Mechanical hazardous fuel treatments – The Forest Plan FEIS (USDA-FS 2007b, p. 2-52) defined mechanical hazardous fuel treatments as completed through non-burning methods. These methods included timber harvest, site preparation, release cutting, and roadside brushing. A total of 26,286.1 acres was treated in total with an average of 4,381 acres treated annually (Table 21).

Prior to FY 2013, the ANF counted mechanical hazardous fuel treatments in all forest types. In FY 2013, the ANF modified this definition and now only counts activities in fire-adapted forest types, e.g., oak, which results in a sharp reduction in the accounting of mechanical (non-burning) hazardous fuel treatments.

Manual/mechanical/herbicide treatment for non-native invasive plant species – A total of 622.2 acres of non-native invasive plants (NNIP) was treated across the ANF from FY 2008 through FY 2013. This equates to an average of 103.7 acres treated annually. Treatments were accomplished via stewardship contracts, ANF staff, Federal Correctional Institute (FCI) McKean prison crew, Youth Conservation Corps (YCC), and student interns. Some of the species treated included: garlic mustard (*Alliaria petiolata*), goatsrue (*Galega officinalis*), multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thungbergii*), exotic bush honeysuckles (*Lonicera* sp.), glossy buckthorn (*Frangula alnus*), Japanese knotweed (*Fallopia japonica*) and purple loosestrife (*Lythrum salicaria*).

Herbicide use for NNIP treatment was analyzed and approved under the 2007 Forest Plan. It took three years to move from planning in subsequent project-level environmental analyses to implementation in order to treat NNIP with glyphosate, one of the two approved herbicides under the Forest Plan, the other being sulfometuron methyl. Through the use of stewardship

contracting, NNIP treatment acres have increased in FY 2012 and FY 2013 (see *Treat invasive plants*) and it is anticipated that stewardship authority will be used more extensively in the future for NNIP treatment.

There is a need to analyze additional chemicals and treatment methods to effectively conduct NNIP treatment, for example the use of basal bark treatment for glossy buckthorn treatment. Additionally, there are MAs on the ANF that have not been included in project level analyses and are not anticipated to be included in the near future in which NNIP treatment is needed, west side of the Allegheny Reservoir for example.

Herbicide treatment for wildlife objective – One hundred twenty-one acres were treated with herbicide for to benefit wildlife (treatment of NNIP to improve wildlife habitat).

Wildlife opening creation – Forty-two acres of wildlife openings were created. This involved clearing the area of trees, shrubs, and large rocks, followed by seeding, fertilizing, and planting. Some openings were planted in warm season grasses while others were planted in cool season grasses with a scattering of shrubs and fruit trees.

Wildlife enhancements – A total of 43,160 acres of wildlife enhancements were implemented, including: wildlife opening construction, rehabilitation, and maintenance; planting of fruit trees, shrubs, mast trees, and conifers; establishment of warm season grass fields, vernal pools and wildlife meadows; building, installing, and maintaining nest boxes and bat boxes; and vegetation management activities benefiting wildlife habitat (see *Enhance terrestrial wildlife habitat*).

In addition, in FY 2013, the ANF worked with the National Forest Foundation and PGC to replace water control structures at Buzzard Swamp, a designated Wildlife Management Area (MA 6.3) comprised of a complex of 14 ponds with water control structures interspersed with fields, crab apple orchards, nesting structure, and unregulated ponds. With the ability to manage and control water levels, the wetland habitat in the Buzzard Swamp will be able to be manipulated in a fashion that increases the abundance and diversity of plant species that are beneficial to waterfowl and shorebirds. An increase in the invertebrate population in the impoundments is expected as well as the ability to expose mudflats during the peak migration of shorebirds, thus creating optimum habitat for a number of critical species.

Stream restoration – A total of 56 projects restored and enhanced aquatic ecosystems within 221 stream miles using structural or non-structural improvements, including: road and stream crossing decommissioning, dam removals, installation of fish habitat improvement structures, riparian plantings, stream bank stabilizations, numerous aquatic organism passage projects, and the annual Allegheny River Cleanup, Conewango Creek Cleanup, and Brokenstraw Creek Cleanup (see *Complete stream restoration/enhancement projects*).

Fish habitat structures – 966 fish habitat structures, e.g., Christmas trees, porcupine cribs, and junior porcupine cribs, were placed in the Allegheny Reservoir and equated to 96.6 acres of fish habitat improvement (see *Complete fish habitat improvement projects*).

Table 21. Comparison of projected Fuels, NNIS, Wildlife, Fish and Stream Activities (USDA-FS 2007a, p. 2) to actual accomplishments (FY 2008-2013)

Management Activity	Average Annual Projected Level (Decade One)	Total Actual Accomplishment	Annual Actual Accomplishment (Average)
Mechanical Hazard Fuel Treatments (Acres)	350	26,286.1	4,381
Manual/Mechanical Treatment for Non-native Invasive Plant Species (Acres)	500	475.5	79.25
Herbicide Treatment for Non-native Invasive Plant Species (Acres)	110	146.7	24.45
Herbicide Treatment for Wildlife Objective (Acres)	105	121	20.2
Wildlife Opening Creation (Acres)	15	42	7
Wildlife Enhancements (Acres)	1,600	43,160	7,193
Stream Restoration (Miles)	2	221	36.8
Fish Habitat Structures (Acres)	32	96.6	16.1

Transportation activities

No Forest Plan objectives were set for road construction, reconstruction, or area cleared for gravel pits (Table 22). The level of annual accomplishment is dependent on the location and amount of timber offered for sale each fiscal year. These actions support the Transportation System goal listed in the Forest Plan on page 16 ("Forest infrastructure…, is in balance with needed management actions").

Road construction/reconstruction – A large portion of the road construction and reconstruction occurred on timber sales to provide access for hauling timber, and protecting soil and water resources from adverse effects attributed to runoff. Additional funding for road reconstruction was provided through ARRA. Some ARRA projects were on Township roads in support of general Forest traffic and/or in support of future timber sales. The miles of Road Construction – Existing Corridor occurred predominantly on existing oil and gas roads that were upgraded to Forest Service standards and guidelines under timber sale contracts. The 9.3 miles of Road Construction – New Corridor created new access to timber harvest units where none existed. The 221.4 miles of Road Reconstruction involved work on existing roads beyond the level of annual maintenance directed through timber sales and public works contracts.

Road decommissioning – The level of road decommissioning refers only to Forest system roads. 5.8 miles of Forest systems roads were decommissioned.

Area cleared for gravel pits – The pit run stone material used for Forest Service road work equated to roughly 137,750 cubic yards of material, or 14.2 acres. This material came from several different pits so an actual acreage is not reported. This figure does not include pit material used for oil, gas, and minerals (OGM) access needs. It should be noted that the Forest Service is currently not using pit material from on-Forest.

Table 22. Comparison of projected transportation activities (USDA-FS 2007a, p. 22) to actual accomplishments (FY 2008-2013)

Management Activity	Average Annual Projected Level (Decade One)	Total Actual Accomplishment	Annual Actual Accomplishment (Average)
Road Construction-Existing Corridor (Miles)	13	21.1	3.5
Road Construction-New Corridor (Miles)	5	9.3	1.6
Road Reconstruction (Miles)	100	221.4	36.9
Road Decommissioning (System; Miles)	2	5.8	1.0
Area Cleared for Gravel Pits (Acres)*	5	14.2	2.4

* Conversion from cubic yards of stone to acres cleared for pits: 9700 cubic yards per acre

Timber management practices by Management Area

The sum of all individual treatment activities does not equate to the total acreage of projected timber harvest because more than one type of harvest activity may occur on any given acre (Table 23). For example, an area may be thinned in one decade, followed by a shelterwood seed cut and removal cut in the following decade.

Intermediate thinning – During the past six years, intermediate thinning harvests sold have slightly exceeded the average annual projected level in the Forest Plan. The amount of intermediate thinning harvests sold has been declining in the last few years. Intermediate thinning harvests sold in FY 2013 are roughly half of what were sold in FY 2012. The figures displayed in Table 23 include salvage and sanitation harvest which occur in response to tree decline and mortality. These acreages are difficult to predict, but it is assumed a salvage harvest component will continue in future years as economic value of trees killed by insects, diseases and weather events is recovered through salvage harvests.

Shelterwood seed cuts – Shelterwood seed cuts sold during FY 2008 through FY 2013 have been below projections in the Forest Plan particularly in MA 3.0. Shelterwood seed cuts sold have generally been increasing since implementation of the Forest Plan began. In FY 2011 and FY 2012, shelterwood seed cuts sold nearly met Forest Plan projections. Shelterwood seed cuts sold in FY 2013 were less than previous years. Overall, shelterwood seed cuts sold annually have averaged 60% of Forest Plan projections for the first decade of implementation.

In addition to shelterwood seed cuts, over 2,800 acres of pre-harvest site preparation and herbicide treatments were implemented between FY 2010 and FY 2013 (a number of areas received both treatments). These treatments occurred in stands that were considered less than fully stocked and are designed to promote tree seedling establishment more quickly without an interim shelterwood seed cut. These pre-harvest treatments are investments that were implemented using newer stewardship contracting and agreement authorities that have provided opportunities to accomplish work that otherwise would not have been possible given typical funding levels. Once seedlings are established in these areas, final harvests may occur.

Even-aged regeneration harvests – Even-aged regeneration harvests, or final harvests, typically follow shelterwood seed cuts and reforestation treatments and occur once adequate tree seedlings

have become established. Final harvests sold during FY 2008 through FY 2013 have been far below Forest Plan projections, particularly in MA 3.0. Final harvests sold during this time frame annually have averaged 27% of Forest Plan projections for the first decade of implementation. This has implications for achieving desired age and structural class objectives and desired vegetation conditions in the Forest Plan (see *Provide vegetative diversity* and *Maintain or create age class diversity*).

There are several reasons that final harvests sold are below levels projected in the Forest Plan. These include the number of shelterwood seed cuts initially prescribed, interfering vegetation that must be treated to promote tree seedling establishment, more sporadic and less abundant seed crops for some tree species, poorly distributed seed trees where mortality or windthrow has impacted overstory tree stocking, and inadequate tree seedling establishment. Additionally, poor timber markets in recent years have slowed harvest rates for shelterwood seed cuts that have been sold or are under contract, delaying subsequent reforestation treatments and final harvests.

Uneven-aged regeneration harvests – Single-tree and group selection uneven-aged regeneration harvests fall below levels projected in the Forest Plan. Overall, uneven-aged regeneration harvests sold between 2008 and 2013 annually have averaged 17% of Forest Plan projections for the first decade of implementation. New techniques in sustaining forest types on the ANF using uneven-aged regeneration methods are being applied, with an emphasis on monitoring treatment effectiveness and making adjustments if needed in order to achieve desired vegetation conditions.

With the exception of intermediate thinning, actual acres sold for various types of timber harvest using different silvicultural methods were less than that projected in the Forest Plan. This means that achievement of desired vegetation conditions is less than projected in the Forest Plan.

Overall, approximately 58% of harvests sold between FY 2008 and FY 2013 consisted of even-aged regeneration treatments. Most recently, two-thirds of current (FY 2013) harvests sold consisted of even-aged stand regeneration treatments.

Final harvest rates continue to lag behind projected levels in the Forest Plan particularly in MA 3.0. However, shelterwood seed cuts sold exceed final harvest acreages sold, and a substantial number of acres have either received a shelterwood seed cut or pre-harvest reforestation treatments, or are under contract to receive a shelterwood seed cut. It is expected that final harvest rates will increase in future years as tree seedlings become established in these areas and the final harvests are implemented.

In the long term, if acres treated through timber harvest continue to be lower than Forest Plan projections, landscape-level desired vegetative conditions and Forest Plan goals and objectives related to forest vegetation will not be met. It is recommended to maintain or increase implementation rates, with a particular emphasis on increasing final harvest rates within MA 3.0. Continue monitoring outputs and services designed to move the Forest towards desired landscape-level vegetation conditions.

Table 23. Comparison of projected timber harvest management practices by Management Area (USDA-FS 2007a, p. 23) to actual accomplishments (FY 2008-2013)

Management Area	Average Annual Projected Level (Decade One; Rounded to Nearest 10 Acres)	Total Actual Accomplishment	Annual Actual Accomplishment (Average)
Intermediate Thinning			
MA 2.2	20	515	85.8
MA 3.0	940	5,585	930.8
MA 6.1	40	58	9.7
MA 8.6	0	501	8.3
Total Intermediate Thinning	1,000	6,208	1,035
Shelterwood Seed Cut			
MA 1.0	30	49	8.2
MA 2.2	40	45	7.5
MA 3.0	1,740	6,359	1,059.8
MA 6.1	30	81	13.5
MA 8.6	0	152[1]	25.3
Total Shelterwood Seed Cut	1,840	6,686	1,114
Acres of Even-aged Regeneration Harvest (Shelterwood Removal Cut and/or Clearcut)			
MA 1.0	30	0	0
MA 2.2	20	215[2]	35.8
MA 3.0	1,690	2,504	417.3
MA 6.1	10	88	14.7
MA 7.2	0	25[3]	4.2
MA 8.6	0	31[1]	5.2
Total Even-aged Regeneration Harvest	1,750	2,863	477
Acres of Uneven-aged Regeneration Harvest			
MA 2.1	50	0	0
MA 2.2	620	461	76.8
MA 3.0	0	141[4]	23.5
MA 6.1	10	81	13.5
Total Uneven-aged Regeneration Harvest	670	683	114

[1] 50 acres of intermediate thinning, 152 acres of shelterwood seed harvest, and 31 acres of shelterwood removal harvests were sold in Kane Experimental Forest as part of research studies. As this is an Experimental Forest, and managed for research and demonstration, the Forest Plan did not project scheduled timber harvest in this area.

[2] All final harvests in MA 2.2 occurred in shade-intolerant forest types, and were either in response to tree mortality caused by wind and/or insects and disease, or in areas where the even-aged regeneration process was initiated prior to 2007.

[3] A 25 acre shelterwood removal was sold in MA 7.2 as a continuation and final harvest in an oak study with NRS. This final harvest is consistent with Forest Plan direction for MA7.2 (USDA-FS 2007a, p. 139).

[4] 141 acres of single tree selection sold was prescribed in three areas in order to maintain more contiguous forest cover for wildlife, riparian habitats, and scenic integrity. All of these areas will receive group selection harvest once tree seedlings have become established.

Timber volume sold

One key decision of the Forest Plan is the identification of the ASQ of timber. The ASQ is measured in cubic feet, although conversions are produced for board feet. Table 24 compares the FY 2008 through FY 2013 sold accomplishments with the ASQ in cubic volume measure and the board foot equivalent. Only the cubic volume is the controlling measure for evaluating compliance with the requirement not to exceed the ASQ in the plan period. Since FY 2007 was a transition year, the first full year in Decade 1 was actually FY 2008. Timber volume sold between FY 2008 and FY 2013 averaged 5.2 million cubic feet per year, or approximately 58% of that projected in the Forest Plan to be awarded annually.

Table 24. Comparison of average annual ASQ (USDA-FS 2007a, p. 24) to timber volume sold (FY 2008-2013)

		Volume Sold						
Unit of Measure	**Average Annual ASQ (Decade 1)**	**FY 2008[1]**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**Average Annual**
Million Cubic Feet (MMCF)	8.9	2.9	4.3	6.4	6.5	5.8	5.4	5.2
Million Board Feet Equivalent (MMBF)	54.1	17.7	26.7	39.3	40.2	35.8	33.3	32.2

[1] FY 2008 volume sold is correctly reported here; it was incorrect in the FY 2008 Monitoring and Evaluation Report (USDA-FS 2008a).

Many factors influence the overall value of the volume offered, including timber markets, demand for timber products, species, overall quality, amount of sawtimber, and size classes of timber being sold. Partial harvests such as intermediate thinnings and shelterwood seed cuts tend to remove more trees in the smaller size classes, resulting in less overall value. Conversely, final harvests result in the removal of most of the trees in the stand, and typically include the largest and highest value trees.

Prescriptions and effects

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Prescriptions and effects (36 CFR 219.12(k)(2))	How have prescriptions and effects been measured?	Annual	Annual	A/B

Protocol – Timber sale marking checks were conducted on 85 stands by gathering new silvicultural examination plot data for stands that had been marked to implement silvicultural prescriptions (intermediate thinnings and shelterwood seed cuts) on the ANF. The plot data was used to generate new SILVAH summaries for each monitored stand to determine whether the marking followed the silvicultural prescription.

SILVAH is the local stand analysis program developed by NRS. The program is used to evaluate vegetation data, quantify silvicultural characteristics of a stand, and develop silvicultural prescriptions. SILVAH was used to summarize examination data in order to analyze existing and resulting stand composition and stocking (relative density and basal area). This summary information was compared to the initial silvicultural prescription to assess the degree to which the harvest phase of the prescription would be met.

Silvicultural prescriptions include a description of existing stand stocking (crowding) and desired stocking levels that will achieve defined silvicultural objectives. Treatments are prescribed to move the stand from existing conditions toward desired conditions. Silvicultural objectives can include providing additional growing space throughout the stand to enhance overall growth and vigor, or reducing overstory stocking in order to reduce shading of the forest floor so seedlings can become established and meet stand regeneration objectives.

ANF silvicultural prescriptions and marking guidelines for implementation also describe existing and desired stand stocking in terms of basal area per acre (a measure of stocking based on square feet of standing growing stock per acre), most often by size class. Basal area is a readily measured stand characteristic that can be checked in the field by crews with a prism as they are marking an area to meet a silvicultural prescription.

Relative density is a measure of crowding or stocking among the trees of a stand and thus is correlated to the degree of understory shading. In addition to basal area measurements, relative density also takes into account tree species, stand stratification, and crown shape. As a result, relative density provides a more realistic estimation of overstory crowding and subsequent shading of the forest floor than basal area (Brose et al. 2008).

Results – Certified silviculturists prepared or reviewed the prescriptions. Coordination with other resource uses was considered sufficient for all reviewed stands. Less common tree species were retained in all reviewed stands, consistent with silvicultural prescriptions.

Relative density

Table 25 summarizes monitoring and evaluation of prescription effectiveness in achieving prescribed stand stocking levels as measured by relative density.

Table 25. Prescription effectiveness monitoring using marking checks for relative density objectives (FY 2008-2013)

	Degree to which Prescription Achieved Specified Relative Density Objective (Percent of Monitored Stands)			
Treatment	**Very Good (<10% Relative Density Difference)**	**Acceptable (11-20% Relative Density Difference)**	**Marking Did Not Fully Meet Prescribed Objective (> 20% Relative Density Difference)**	**Unable to Evaluate**
Intermediate Thinning	50%	19.5%	11%	19.5%
Thinning to Accelerate Mature Forest Conditions	100%	-	-	-
Shelterwood Preparation Cut	100%	-	-	-
Shelterwood Seed Cut	56%	37%	5%	2%
Single Tree Selection	100%	-	-	-

Basal area

Table 26 summarizes monitoring and evaluation of prescription effectiveness in achieving prescribed stand stocking levels as measured by basal area.

Table 26. Prescription effectiveness monitoring using marking checks for basal area objectives (FY 2008-2013)

	Degree to Which Prescription Achieved Specified Basal Area Objective (Percent of Monitored Stands)			
Treatment	**Very Good (<10 ft^2/ac Basal Area Difference)**	**Acceptable (11-20 ft^2/ac Basal Area Difference)**	**Marking Did Not Fully Meet Prescribed Objective (>20 ft^2/ac Basal Area Difference)**	**Unable to Evaluate**
Intermediate Thinning	58%	22%	20%	n/a
Thinning to Accelerate Mature Forest Conditions	100%	-	-	-
Shelterwood Preparation Cut	100%	-	-	-
Shelterwood Seed Cut	51%	34%	12%	3%
Single Tree Selection	100%	-	-	-

Intermediate thinning

Timber sale marking checks were completed for 36 intermediate commercial thinning prescriptions on the ANF. Intermediate thinning has an overall objective in reducing stand crowding (stocking) in order to enhance overall stand growth, vigor, composition, and quality.

Overall, 70% of intermediate thinning prescriptions evaluated were marked in a manner that would achieve silvicultural prescription relative density stocking objectives. Eighty percent of sampled stands met basal area stocking objectives specified in silvicultural prescriptions.

Four of the 36 stands monitored (11%) had residual relative densities that deviated by more than 20% of the target amount, and seven (20%) had residual basal areas that deviated by more than 20 ft^2/ac of that specified. Between relative density and basal area measures, six monitored stands did not reduce stand stocking enough to fully meet intermediate thinning stocking goals; however, treatment of these stands will still result in an overall increase in growth and vigor. One monitored stand was marked to reduce both target relative density and basal area below prescribed levels in a newer prescription for oak release. In this case, too many poles were marked for removal in the prescription.

Nearly 20% of sampled stands were unable to be evaluated with regard to relative density objectives as relative densities were not specified in the silvicultural prescriptions reviewed. Following the FY 2008 Monitoring and Evaluation Report (USDA-FY 2008a), the ANF developed a more standardized silvicultural prescription template which places greater emphasis on incorporating relative density measures into silvicultural prescriptions and marking guidelines to implement those prescriptions.

Prescriptions were implemented well in most stands. In all cases, the thinning will achieve the reductions in stand crowding (stocking) specified in the prescriptions. In all cases, stands marked for intermediate thinning that were monitored will result in increased growing space for residual trees, increasing overall growth and vigor, while featuring a diversity of tree species.

Thinning to accelerate mature forest conditions

Timber sale marking checks were completed for two intermediate commercial thinnings to accelerate mature forest conditions. These thinnings are designed to achieve late structural objectives by developing larger trees within a stand and creating heterogeneous stand structure. Further description of this treatment is located in Appendix A of the Forest Plan on page A-26. Field checks revealed that marking met these stocking objectives, including specified relative densities and basal areas prescribed in the treatments. In both cases, marking introduced the desired heterogeneity, restored oak species importance, and retained larger, healthy individual stems.

Shelterwood preparation cut

Timber sale marking checks were completed for two shelterwood preparation prescriptions. Both of these treatments were prescribed in oak forest types and were designed to enhance growth and vigor of oak seed trees, provide additional light to the forest floor for oak seedling establishment, and improve overall oak composition in treated areas. Field checks revealed that the marking met these stocking objectives, including specified relative densities and basal areas prescribed in the treatments. A diversity of trees was retained in both shelterwood preparation cuts, and the importance of oak in these stands was increased.

Shelterwood seed cut

Timber sale marking checks were completed for 41 shelterwood seed cut prescriptions on the ANF. The vast majority (93%) were marked in a manner that would achieve target relative densities specified in the silvicultural prescriptions. Eight-five percent of shelterwood seed cuts monitored were marked in a manner that would achieve target basal area stocking levels prescribed.

Five of the 41 stands evaluated (12%) deviated by more than 20 20 ft^2/ac of target residual basal area. Three of these stands did not reduce stand basal area enough. Subsequent non-commercial site preparation will reduce basal area more by removing poles from the stand. The remaining two stands reduced basal area more than specified, but still retained a diversity of seed trees well distributed across these stands.

All stands that receive a shelterwood seed cut are closely monitored to determine if seedlings develop or if subsequent reforestation treatments are needed in order to achieve regeneration objectives and proceed to the final removal harvest. The overall prescription objective of increasing light to the forest floor and providing well distributed seed trees was met in all stands evaluated.

Single tree selection

Timber sale marking checks were completed for four single tree selection prescriptions. Single tree selection has an objective of removing individual trees or small clusters of trees to increase sunlight on the forest floor for tree seedling establishment, and transition even-aged stands toward an uneven-aged structure. Typically on the ANF, single tree selection is followed by group selection once sufficient desirable trees seedlings are established.

All single tree selection prescriptions monitored met prescription objectives of removing individual trees or small clusters of trees to increase sunlight on the forest floor for seedling establishment. All four single tree selection prescriptions that were monitored met specified relative densities levels prescribed in the treatments. One stand evaluated did not reduce basal area enough, but met specified relative density stocking level. Adequate, well distributed seed trees are present in all stands evaluated. All stands that receive a single tree selection harvest are closely monitored to determine if seedlings develop or if subsequent reforestation treatments are needed.

Conclusions – Overall, the monitored silvicultural prescriptions integrated various resource considerations and met objectives to move landscapes toward desired conditions established in the Forest Plan. All prescriptions evaluated retained a diversity of tree species.

Recommendations – Ongoing follow-up conversations with District silviculture staff regarding prescription effectiveness monitoring has resulted in the following recommendations:

- Continue monitoring implementation of silvicultural prescriptions in all types of prescriptions.
- Continue utilizing relative density measures of stand crowding in silvicultural prescription development.
- Continue utilizing local guidelines for silvicultural prescription development in Allegheny Plateau hardwoods (Marquis et al. 1994).
- Continue utilizing the standardized ANF silvicultural prescription template designed to ensure all measurable components of silvicultural prescriptions are addressed, including long-term objectives.
- Ensure that the inventory used to write a prescription accurately represents conditions on the ground. Collect updated inventory data in the following situations:
    - Existing data are older than 10 years old.

    - Original stand boundaries are significantly differently than actual treatment boundaries.
    - When it is suspected that stand composition, stocking, or distribution has changed since the last inventory (e.g. BBD, windthrow, general decline, etc.).
- Clumpy stocking in the stand being marked may end up being marked to a lower relative density than specified due to the removal of trees in more densely stocked portions of these stands. Where clumpy distribution occurs, or mortality such as BBD-caused mortality has impacted a stand, the shelterwood seed cut may actually require the residual relative density to fall below 50%.
- Account for sapling stocking in the prescription when it exceeds 5% of the total stand relative density.

Comparison of actual and estimated costs

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Comparison of actual and estimated costs (36 CFR 219.12(k)(3))	What are actual costs in comparison to estimated costs?	5 years	5 years	A

Protocol – Costs are estimated annually before each FY begins as the Forest's program of work is developed taking into account program needs, e.g., salary, materials, supplies, contracts, agreements, vehicle use, etc., for the upcoming FY. The actual cost of Forest Plan implementation for each FY is reflected in the Forest's actual expenditures realized during the FY (October 1 – September 30).

Results – The program areas displayed in the first column of Table 27 include most of the Forest's annual operations. These operations relate to specific management goals and objectives in the Forest Plan. On average, the Forest's actual expenditures were about 89% of estimated costs with a range of 70% (FY 2012) to 98% (FY 2011).

Table 27. Annual estimated and actual costs of Forest Plan implementation (FY 2008-2013)

		2008		2009	
Fund Name	**BLI**	**Estimated**	**Actual**	**Estimated**	**Actual**
		National Forest Systems - NFNF			
Inventory & Monitoring	NFIM	$ -	$ -	$ 651,800	$ 623,255
Landowner Management	NFLM	$ 246,000	$ 231,894	$ 321,500	$ 309,973
Minerals & Geology Management	NFMG	$ 892,000	$ 827,585	$ 1,974,235	$ 2,203,548
Native Plants	NFN3	$ 28,000	$ 26,653	$ -	$ -
Forest Planning	NFPN	$ 108,000	$ 102,267	$ 120,000	$ 113,234
Recreation, Heritage, & Wilderness	NFRW	$ 899,800	$ 899,912	$ 997,532	$ 1,084,232
Timber Sale Management	NFTM	$ 1,639,800	$ 1,514,829	$ 2,145,464	$ 2,156,825
Vegetation & Watershed Management	NFVW	$ 775,200	$ 709,382	$ 933,301	$ 862,950
Wildlife & Fisheries Habitat Mgt.	NFWF	$ -	$ -	$ 348,300	$ 354,206
Total National Forest Systems - NFNF	**NFNF**	**$ 4,588,800**	**$ 4,312,521**	**$ 7,492,132**	**$ 7,708,222**
		Wildland Fire Management - WFWF			
Wildland Fire Preparedness	WFPR	$ 310,000	$ 279,596	$ 425,000	$ 423,584
Hazardous Fuels Reduction	WFHF	$ 54,000	$ 49,824	$ 54,000	$ 58,577
Total Wildland Fire Management - WFWF		**$ 364,000**	**$ 329,420**	**$ 479,000**	**$ 482,160**
		Capital Improvements & Maintenance - CMCM			
Facilities Capital Improvements & Maintenance	CMFC	$ 119,000	$ 111,717	$ 1,196,000	$ 1,127,895
Legacy Roads (TRTR)	CMLG	$ 209,000	$ 192,160	$ 145,700	$ 94,307
Roads Capital Improvements & Maintenance	CMRD	$ 1,180,100	$ 1,103,727	$ 1,296,900	$ 1,289,855
Trails Capital Improvements & Maintenance	CMTL	$ 278,600	$ 253,674	$ 265,000	$ 259,711
Facilities Maintenance (CP09)	CP09	$ 285,000	$ 282,748	$ 292,400	$ 267,659
Total Capital Improvements & Maintenance - CMCM		**$ 2,071,700**	**$ 1,944,026**	**$ 3,196,000**	**$ 3,039,427**
		Land Acquisition - LALW			
Land Acquisition	LALW	$ 35,000	$ 36,464.96	$ 14,000	$ 7,655.48
Total Land Acquisition - LALW		**$ 35,000**	**$ 36,465**	**$ 14,000**	**$ 7,655**
Total Appropriated Funds		**$ 7,059,500**	**$ 6,622,432**	**$ 11,181,132**	**$ 11,237,465**
		Perms & Trust Funds (Not All Inclusive)			
Fund Name	**BLI**				
Cooperative Work - NONAGT Based	CWF2	$ 350,000	$ 300,442	$ 355,300	$ 376,349
Cooperative Work - Other	CWFS	$ 140,500	$ 73,608	$ 192,935	$ 40,355
Regional K-V Sale Area Projects	CWK2	$ -	$ -	$ -	$ -
K-V Sale Area Projects	CWKV	$ 1,154,400	$ 1,029,087	$ 1,600,000	$ 1,129,320
Unit Recreation Enhancement	FDDS	$ 250,000	$ 210,854	$ 184,000	$ 98,041
Federal Highway Administration Expense	HTAE	$ 8,000	$ 6,020	$ 7,000	$ 4,988
Federal Highway Aquatic Passage	HTAP	$ 17,000	$ 14,760	$ -	$ -
Federal Highway Scenic Byways	HTBW/HTFB	$ 6,000	$ 6,038	$ 3,000	$ 3,004
Federal Highway - Public Roads	HTRP	$ -	$ -	$ -	$ -
Maps for Visitors & Other Rec (MVIS & MSEQ)	MAPS	$ 10,000	$ -	$ 16,000	$ -
Reforestation Trust Funds	RTRT	$ 234,000	$ 223,531	$ 226,100	$ 221,546
Salvage Sale	SSSS	$ 1,456,351	$ 1,222,111	$ 1,000,000	$ 715,890
Stewardship Contracting	SSCC	$ -	$ -	$ -	$ -
Timber Pipeline - Sale Prep	TPPS	$ 918,800	$ 858,623	$ 723,000	$ 568,911
Total Perms & Trust Funds		**$ 4,545,051**	**$ 3,945,073**	**$ 4,307,335**	**$ 3,158,404**
OVERALL TOTAL		**$ 11,604,551**	**$ 10,567,505**	**$ 15,488,467**	**$ 14,395,868**
PERCENT SPENT		**91%**		**93%**	

		2010		2011	
Fund Name	**BLI**	**Estimated**	**Actual**	**Estimated**	**Actual**
		National Forest Systems - NFNF			
Inventory & Monitoring	NFIM	$ 618,000	$ 608,802	$ 477,000	$ 441,533
Landowner Management	NFLM	$ 274,000	$ 299,923	$ 248,000	$ 257,714
Minerals & Geology Management	NFMG	$ 1,225,892	$ 1,537,362	$ 892,152	$ 919,869
Native Plants	NFN3	$ 20,000	$ 18,440	$ 18,000	$ 14,135
Forest Planning	NFPN	$ 146,000	$ 138,724	$ 84,000	$ 81,048
Recreation, Heritage, & Wilderness	NFRW	$ 952,436	$ 962,664	$ 929,716	$ 820,689
Timber Sale Management	NFTM	$ 2,797,038	$ 2,743,141	$ 2,625,947	$ 2,520,273
Vegetation & Watershed Management	NFVW	$ 579,161	$ 549,897	$ 671,656	$ 634,263
Wildlife & Fisheries Habitat Mgt.	NFWF	$ 360,000	$ 361,498	$ 351,000	$ 368,655
Total National Forest Systems - NFNF	**NFNF**	**$ 6,972,527**	**$ 7,220,450**	**$ 6,297,471**	**$ 6,058,179**
		Wildland Fire Management - WFWF			
Wildland Fire Preparedness	WFPR	$ 405,000	$ 368,132	$ 416,000	$ 362,167
Hazardous Fuels Reduction	WFHF	$ 64,000	$ 51,735	$ 218,000	$ 216,348
Total Wildland Fire Management - WFWF		**$ 469,000**	**$ 419,868**	**$ 634,000**	**$ 578,515**
		Capital Improvements & Maintenance - CMCM			
Facilities Capital Improvements & Maintenance	CMFC	$ 486,000	$ 463,825	$ 221,000	$ 224,817
Legacy Roads (TRTR)	CMLG	$ 905,000	$ 915,131	$ 75,000	$ 75,155
Roads Capital Improvements & Maintenance	CMRD	$ 1,356,387	$ 1,358,522	$ 1,029,169	$ 1,007,454
Trails Capital Improvements & Maintenance	CMTL	$ 299,000	$ 285,066	$ 340,028	$ 331,920
Facilities Maintenance (CP09)	CP09	$ 265,000	$ 259,041	$ 282,700	$ 264,042
Total Capital Improvements & Maintenance - CMCM		**$ 3,311,387**	**$ 3,281,584**	**$ 1,947,897**	**$ 1,903,389**
		Land Acquisition - LALW			
Land Acquisition	LALW	$ 25,000	$ 15,955.14	$ 34,000	$ 27,660.11
Total Land Acquisition - LALW		**$ 25,000**	**$ 15,955**	**$ 34,000**	**$ 27,660**
Total Appropriated Funds		**$ 10,777,914**	**$ 10,937,857**	**$ 8,913,368**	**$ 8,567,742**
		Perms & Trust Funds (Not All Inclusive)			
Fund Name	**BLI**				
Cooperative Work - NONAGT Based	CWF2	$ 500,000	$ 365,552	$ -	$ 941,511
Cooperative Work - Other	CWFS	$ 27,991	$ 20,712	$ 25,504	$ 16,079
Regional K-V Sale Area Projects	CWK2	$ 820,000	$ 799,960	$ 622,000	$ 606,848
K-V Sale Area Projects	CWKV	$ 1,627,000	$ 1,034,064	$ 1,400,000	$ 1,009,880
Unit Recreation Enhancement	FDDS	$ 96,698	$ 50,859	$ 252,000	$ 76,145
Federal Highway Administration Expense	HTAE	$ 10,000	$ 7,220	$ 10,000	$ 8,774
Federal Highway Aquatic Passage	HTAP	$ 10,000	$ 3,936	$ 15,000	$ -
Federal Highway Scenic Byways	HTBW/HTFB	$ -	$ -	$ -	$ -
Federal Highway - Public Roads	HTRP	$ -	$ -	$ -	$ -
Maps for Visitors & Other Rec (MVIS & MSEQ)	MAPS	$ 55,000	$ 6,750	$ 10,000	$ -
Reforestation Trust Funds	RTRT	$ 201,000	$ 193,334	$ 140,000	$ 138,603
Salvage Sale	SSSS	$ 371,498	$ 345,304	$ 294,000	$ 206,215
Stewardship Contracting	SSCC	$ 130,722	$ 56,027	$ 113,000	$ 73,017
Timber Pipeline - Sale Prep	TPPS	$ 362,000	$ 265,835	$ 590,000	$ 489,693
Total Perms & Trust Funds		**$ 4,211,909**	**$ 3,149,555**	**$ 3,471,504**	**$ 3,566,765**
OVERALL TOTAL		**$ 14,989,823**	**$ 14,087,411**	**$ 12,384,872**	**$ 12,134,508**
PERCENT SPENT		**94%**		**98%**	

		2012		2013	
Fund Name	**BLI**	**Estimated**	**Actual**	**Estimated**	**Actual**
		National Forest Systems - NFNF			
Inventory & Monitoring	NFIM	$ 413,516	$ 272,146	$ 414,000	$ 357,945
Landowner Management	NFLM	$ 248,000	$ 187,059	$ 217,932	$ 246,605
Minerals & Geology Management	NFMG	$ 1,206,932	$ 866,706	$ 1,245,000	$ 1,143,517
Native Plants	NFN3	$ -	$ -	$ -	$ -
Forest Planning	NFPN	$ 53,000	$ 44,323	$ 66,000	$ 60,146
Recreation, Heritage, & Wilderness	NFRW	$ 928,066	$ 720,438	$ 849,042	$ 793,510
Timber Sale Management	NFTM	$ 2,683,858	$ 1,947,838	$ 2,841,336	$ 2,841,631
Vegetation & Watershed Management	NFVW	$ 810,000	$ 602,343	$ 815,085	$ 734,474
Wildlife & Fisheries Habitat Mgt.	NFWF	$ 392,000	$ 284,805	$ 392,000	$ 370,651
Total National Forest Systems - NFNF	**NFNF**	**$ 6,735,372**	**$ 4,925,659**	**$ 6,840,395**	**$ 6,548,478**
		Wildland Fire Management - WFWF			
Wildland Fire Preparedness	WFPR	$ 360,000	$ 231,656	$ 360,000	$ 302,128
Hazardous Fuels Reduction	WFHF	$ 80,000	$ 76,314	$ 80,000	$ 70,692
Total Wildland Fire Management - WFWF		**$ 440,000**	**$ 307,970**	**$ 440,000**	**$ 372,820**
		Capital Improvements & Maintenance - CMCM			
Facilities Capital Improvements & Maintenance	CMFC	$ 196,000	$ 150,307	$ 181,000	$ 160,535
Legacy Roads (TRTR)	CMLG	$ -	$ -	$ 100,000	$ -
Roads Capital Improvements & Maintenance	CMRD	$ 987,031	$ 719,300	$ 1,037,842	$ 1,067,865
Trails Capital Improvements & Maintenance	CMTL	$ 458,996	$ 330,245	$ 257,000	$ 228,557
Facilities Maintenance (CP09)	CP09	$ 280,000	$ 158,652	$ 280,000	$ 328,277
Total Capital Improvements & Maintenance - CMCM		**$ 1,922,027**	**$ 1,358,504**	**$ 1,855,842**	**$ 1,785,234**
		Land Acquisition - LALW			
Land Acquisition	LALW	$ 31,000	$ 27,089.10	$ 27,000	$ 27,927.21
Total Land Acquisition - LALW		**$ 31,000**	**$ 27,089**	**$ 27,000**	**$ 27,927**
Total Appropriated Funds		**$ 9,128,399**	**$ 6,619,222**	**$ 9,163,237**	**$ 8,734,460**
		Perms & Trust Funds (Not All Inclusive)			
Fund Name	**BLI**				
Cooperative Work - NONAGT Based	CWF2	$ 951,000	$ 524,839	$ 764,000	$ 311,672
Cooperative Work - Other	CWFS	$ 25,000	$ 2,958	$ -	$ 5,481
Regional K-V Sale Area Projects	CWK2	$ 68,700	$ 60,845	$ 77,000	$ 80,334
K-V Sale Area Projects	CWKV	$ 1,350,000	$ 844,451	$ 1,347,000	$ 930,438
Unit Recreation Enhancement	FDDS	$ 62,000	$ 45,931	$ 383,000	$ 162,086
Federal Highway Administration Expense	HTAE	$ 13,000	$ 9,110	$ 2,000	$ 2,073
Federal Highway Aquatic Passage	HTAP	$ -	$ -	$ -	$ -
Federal Highway Scenic Byways	HTBW/HTFB	$ -	$ -	$ -	$ -
Federal Highway - Public Roads	HTRP	$ 3,040	$ 2,021	$ -	$ -
Maps for Visitors & Other Rec (MVIS & MSEQ)	MAPS	$ 15,000	$ -	$ 15,000	$ -
Reforestation Trust Funds	RTRT	$ 126,000	$ 111,898	$ 156,600	$ 154,282
Salvage Sale	SSSS	$ 330,000	$ 273,914	$ 475,000	$ 393,034
Stewardship Contracting	SSCC	$ 87,000	$ 84,800	$ 82,000	$ 78,599
Timber Pipeline - Sale Prep	TPPS	$ 230,000	$ 147,051	$ 1,134,000	$ 1,121,471
Total Perms & Trust Funds		**$ 3,260,740**	**$ 2,107,817**	**$ 4,435,600**	**$ 3,239,471**
OVERALL TOTAL		**$ 12,389,139**	**$ 8,727,039**	**$ 13,598,837**	**$ 11,973,931**
PERCENT SPENT		**70%**		**88%**	

Conclusions – Although the tables do not account for the entire budget, e.g., project earmarks, line officer cost pools, and some other administrative costs, it does address most of the resource-related work that was completed to support implementation of the Forest Plan.

The average amount of expenditure indicates that Forest funding allocations were adequate to accomplish its program of work related to Forest Plan implementation and that the Forest stayed within its budget allocated by Congress; however, in 2005, the annual cost of full Forest Plan implementation was projected to be $26,358,000 for the first decade (not adjusted for inflation; USDA-FS 2007b, p. B-81). While the methods of tracking costs have changed and the FEIS projection does not necessarily translate to current budget divisions, the Forest only received and spent an average of 51% and 45% of the total projected cost of full Forest Plan implementation, respectively.

Recommendations – Continue to monitor costs with the objective to efficiently and effectively spend the Forest's allocated budget to meet the needs of Forest Plan implementation.

Effects of management practices

Action, effect or resource to be managed	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Effects of management practices (36 CFR 219.11(d))	To what extent have standards and guidelines been applied?	Annual	Annual	A/B

The purpose of effectiveness monitoring is to evaluate whether the applicable Forest Plan standards and guidelines were followed and whether project-level mitigations achieved the desired outcomes. Project-level effectiveness monitoring was conducted on select management practices from FY 2008 through FY 2013. In addition to the examples that follow, additional effectiveness monitoring completed included:

- *Effectiveness of herbicide design criteria*
- *Prescriptions and effects*
- *Effectiveness of non-native invasive plant controls*

Forest Road 230 timber sale

Protocol – On September 24, 2008, a NEPA review was conducted on two timber stands in the Forest Road (FR) 230 Timber Sale, part of the Spring Creek project. Fourteen resource specialists participated in the review with expertise in forestry (silviculture, sale administration, timber marking), wildlife management, soils, hydrology and landscape architecture present.

Results

Compartment 709/Stand 41 – Payment Unit 36

To protect water quality, mitigation measures require that wet areas be buffered from harvest activities with a minimum 25 foot buffer. This mitigation measure was properly applied to one small wet area on

the eastern side of the stand. Herbicide treatments also protected the wet area by maintaining at least a 25 foot buffer. No additional wet areas were present.

Soil mitigation included proper layout of skid trails and no skid trails on grades greater than 15%. Both of these measures were properly applied. No excessive damage to soils was observed and no skidding occurred through seeps or springs. Approximately 2.6 % of the stand had soil disturbance associated with skid trails and landings (Table 28), less than the 15% Regional standard.

Table 28. Post-harvest soil monitoring of FR 230 Timber Sale – Payment Unit 36

Payment Unit	Acres	Acres in Skid trails	Acres in Landings	Acres in Ruts	Total Acres Disturbed	Percent Disturbed
36	22	0.56	0.03	0.01	0.60	2.6%

Visual mitigation measures included pulling the slash back 25 feet from the road and felling striped maple and beech along the road after applying herbicide. Both of these measures were completed as prescribed.

Wildlife mitigations involved leaving snags, den trees, and conifers. The number of wildlife reserve trees is provided in Table 29.

Table 29. Wildlife reserve trees in FR 230 Timber Sale – Payment Unit 36

	Snags	Den Trees	Potential Den trees	Hemlock	Cavity Trees	Boundary Reserve Trees	Reserve Trees
Total Trees	161	27	30	138	36	67	8
Trees/ Acre	7.3	1.2	1.3	6.2	1.6	3.0	0.4

The measure that requires 5-10 snags per acre has been met. Retention of 16 live trees per acre has been met (since this is a partial harvest); however, substantial beech mortality occurred after the unit was marked and a few reserve trees were cut because of safety concerns. Retention of three live den trees is met if potential den trees are included.

Compartment 708/Stand 10 – Payment Unit 20

Mitigations for soils and water included buffering wet areas and using existing skid trails. One existing skid trail ran through a small wet area. This skid trail was used and care was taken to avoid rutting and excessive soil damage. The unit was relatively flat and no skid trails exceeded a 15% grade. The main skid trails disturbed less than 15% of the unit acreage (Table 30).

Table 30. Post-harvest soil monitoring of FR 230 Timber Sale – Payment Unit 20

Payment Unit	Acres	Acres in Skid trails	Acres in Landings	Acres in Ruts	Total Acres Disturbed	Percent Disturbed
20	15	1.02	0.20	none	1.22	8.1%

No visual or recreation concerns were raised and no mitigations were applied for these resources.

For the wildlife mitigation, 67 snags and 21 den trees (4.4 snags per acre and 1.4 den trees per acre) were left. The wildlife retention measure for a green partial harvest was:

Retain all snags > 9"dbh. Retain at least 16 live trees per acre ≥ 9" dbh. Mark and retain three live den trees per acre. Retain one live tree in the vicinity of about 1/3 of all large diameter (> 12") snags with exfoliating bark.

Since this treatment was a thinning, there are many more live trees retained than the minimum of 16 per acre. There were also many opportunities for additional den trees to develop over time.

Conclusions – The mitigation measures were properly applied and were effective in avoiding/minimizing resource damage.

Recommendations – There are no findings from this project to recommend changes to standards and guidelines in the Forest Plan at this time.

Federal oil and gas development – Tract 13

Protocol – In July 2010, review was conducted on the Tract 13 federal OGD (USA Minerals). This development had six wells drilled using the Energy Policy Action Section 390. The interdisciplinary review team reviewed the three wells located near, but not within, aquatic management zones.

ANF, PADEP, and BLM staff have been inspecting the development since the project was implemented, including inspections by ANF staff in FY 2014.

Results and Conclusions – The July 2010 review found that the environmental planning process was properly followed and Section 390 criteria were fulfilled. The decision and implementation were consistent with 2007 Forest Plan direction. The proposed access roads and well pads were designed to protect surface resources, with a few noted exceptions.

The overall layout and implementation utilized the proper design features to minimize surface disturbance, sediment runoff, and impacts to surface resources. A small spring seep below well 1870 was protected. An exception was found to the 2070 Biological Diversity Guideline in that the seed mix approved in the Erosion and Sedimentation Control Plan contained non desirable non-native invasive species (birdsfoot trefoil, redtop, alsile clover, and timothy) and the allowance of hay for mulching did not conform to a material with the least likelihood of introducing unwanted vegetation.

An Erosion and Sedimentation Control Plan was implemented and was determined to be mostly effective. Good soil stabilization occurred on well sites and access roads. Silt fences were properly installed. Most cross drains had large rock placed at the ends as level spreaders to avoid concentrating flow on the forest floor.

The design features to limit sedimentation reaching intermittent stream crossings on FR 213 had not been implemented fully at the time of the July 2010 review. There was evidence of sediment delivery to these intermittent streams along FR 213. Some limestone had just been placed on FR 213 past the last access road where two intermittent stream crossings occurred. It was a large size stone and appeared to be base material (it had not yet been graded). This did not comply with the FR 213 road log specification which called for 8" of pit run covered with 4" of driving surface aggregate (DSA) limestone. The culverts that needed to be replaced in this section were not completed at time of review.

Field review identified NNIP species in revegetated ditch lines on each well access road**.**

The follow-up inspections indicated FR 213 was surfaced with DSA limestone and culverts were replaced as required by the road log specifications. Additionally, all six well sites exhibited approximately 100% vegetative cover with the exception of the driving access. All cut and fill slopes were stable with no evidence of movement. The well pads were clear of debris and clean. All drainage structures along the access roads were in working condition with no scour.

Recommendations

- The implementation folder was very useful. Continue to use this approach on future federal minerals.
- Direct oil and gas administrators to reference Erosion and Sedimentation Control Plan requirements and the decision mitigations (Conditions for Approval) in inspections.
- When waivers for road construction work are issued in the Notice To Proceed, include timeframes for completion. State the need for final inspection acceptance of all required items.
- Multiflora rose should be treated and monitored. Field surveys found it at proposed well sites 1866, 1869, and 1870. With new road corridors, openings, and ground disturbance, this species is very conducive to spread by birds.

Mud Lick and Chappel 2003 blowdown salvage sales

Background – On July 21, 2003, the ANF was affected by an unusual mesoscale convection system that resulted in an estimated 9,333 acres of blowdown across the Forest. Field crews assessed conditions in areas impacted by the storm over a period of months, in particular areas with concentrations of blown down trees. Timber salvage operation opportunities were identified on some areas of the ANF, and 19 Categorical Exclusion (CE) proposals were developed. Mud Lick and Chappel were two timber salvage sale projects that were approved through CEs. Both Mud Lick (27 acres) and Chappel (39 acres) CEs fell within MA 3.0 on the Bradford Ranger District. The Chappel blowdown area evaluated in this report is now part of MA 2.2 following the 2007 Forest Plan.

Protocol – On October 26, 2010, a NEPA review of Mud Lick and Chappel was conducted to determine if the projects were implemented in compliance with the mitigation measures in the decision documents. The Forest Silviculturist, Forest Hydrologist, Forest Ecologist, and Timber Sale Administrator for the two sales participated in the review.

Results

Mud Lick

Soils and water resources – The salvage operation occurred under optimal, i.e., dry, operating conditions during the summer of 2005, consistent with mitigation measures to protect group 2 soils. Consequently, skid trails were not rutted and did not affect future drainage. To avoid steep grades, skid trails on the east side of the unit were cut into the slope. Trails were constructed during dry conditions with no water evident on the ground surface at the time; however, subsurface flow was intercepted and water now flows down a portion of the skid trail for less than 50 feet. The construction of water bars and dips on the skid trail minimized erosion and changes to hydrology and the cut appeared stable.

Skid trail pattern and density were affected by the pattern of blowdown and slope on the west and east side of the unit, respectively. On the unit's west side, much of the blowdown fell as patches of complete replacement with logs lying perpendicular to one another. The resulting unusual skid trail pattern (e.g., trails running parallel and in close proximity) was necessary as attempts to rotate logs resulted in greater damage to soil resources. Skid trails were designated in the western portion of the salvage area where group 2 soils were present. One wet area was observed on a skid trail in the western portion of the unit, but it did not contain any flowing water. On the unit's east side, skid trails were cut into the steep slopes, which led to a dense layout of wide trails. Some winching was used to pull logs to skidders on designated skid trails.

GIS and orthophotographs were used to determine if soil disturbance exceeded 15% of the unit. Skid trails were digitized on the unit's east side, but could not be identified on the west side. In the field, most sections of skid trail on the western side of the unit were only slightly compacted and are expected to recover. On the east side, there were an estimated 1,858 feet of 13 foot-wide cut bench skid trails amounting to 0.55 acres of detrimental disturbance because the productive soil horizons were removed when the skid trail was cut. The landing on the east side added another 0.07 acres of disturbance. With a harvest area of approximately 6.3 acres, total soil disturbance on the east side represented 9.8%. While this is below the 15% disturbance limit, it is recommended that this method of extraction (cut bench skid trails for tree length skidding) be avoided. If conditions had not been so dry, disturbance could have been much greater.

Mud Lick Run, the stream flowing through the unit, was well-buffered and exceeded 100 feet in width on both sides. Down trees were not removed within the stream buffer. Blowdown that had fallen into the stream did not create pools or result in debris jams. This is likely due to the rockiness of the stream bed and steep slope.

While the deliberate tipping of stumps was not practiced (SW8), some stumps did tip back upright when the bole of the tree was removed.

Vegetation resources – The units were surveyed for sensitive and invasive plants prior to implementation of the timber sale.

Residual overstory canopy in the stand was quite variable, ranging from 10 ft^2/acre of basal area up to an estimated 80 ft^2/acre of basal area. The western portion of the stand had more standing trees remaining on site, while the eastern portion of the stand was nearly 100% blown down. The western portion of the stand more closely resembled a very patchy shelterwood seed harvest, rather than a salvage clearcut. It is anticipated that the seedling regeneration that persisted will be more dominated by shade intermediate and tolerant species, such as beech and birch, in the western portion of the stand, while more shade-intolerant regeneration, such as red maple, black cherry, and aspen, will persist in the eastern portion of the stand where near 100% blowdown occurred.

During the October 2010 monitoring review, black birch and American beech regeneration was observed on the west side of the unit. This side also supported vegetation indicative of wetter soils within its skid trails, including musclewood. Black birch and American beech regeneration was also on the east side as well as red maple, and pin cherry, with quaking aspen becoming established in the skid trails. Evidence of heavy deer browse was observed throughout the unit.

Natural seedling development was been monitored through stocking surveys completed in fiscal years 2006, 2008, and 2010. Stocking survey data from FY 2010 indicated the stand contained 95% interfering vegetation, with 63% of the plots stocked with tree seedlings. Seedling stocking consisted of red maple, birch, black cherry, red oak and black oak, with birch and red maple dominating the sapling size class. American hornbeam (musclewood or blue beech), hophornbeam (ironwood), and American witchhazel were also noted in the FY 2010 stocking survey. Interfering vegetation consisted of blackberry fern, grass, and birch. This unit had remedial reforestation activities approved in the Southwest Reservoir project, including site preparation, herbicide application, planting, release, and fencing.

Wildlife resources – There are no Indiana bat maternity colonies or roost trees known on the Forest. A bald eagle nest was identified and appropriately designated as a reserve area. An abundance of snags were retained and a native seed mix was used to stabilize trails and landings. Wildlife reserve areas were appropriately identified in the field and on the timber sale map, and observed during the salvage operation. Numerous live trees and potential roost trees were still standing and not salvaged. Trees with the tops snapped off or "cat-faced trees" were still standing and had not been harvested. Logs were hauled south on both FR 110 and 110a to Gibbs Hill Road; Longhouse Drive (FR 262) was not used for a haul route to avoid potential disturbance to an active bald eagle nest.

Social and heritage resources – The units were surveyed for heritage sites and cleared for layout and marking. Tree marking paint was applied on the side away from the road. There were no Concern Level 1 roads or trails associated with the unit. Slash disposal zones were indicated on the timber sale map and appeared to have been pulled back 15 feet and lopped down for an additional 25 feet along Concern Level 2 roads (FR 110, FR 120, and FR 141). Timber from the west half of the unit was decked on FR 141 and the road surface was not impacted. Timber from the eastern portion of the unit was decked on a small landing on the west side of FR 110. The landing was restored and reseeded. Both landings were located on or next to a road in order to minimize soil disturbance. The unit was not located near the North Country National Scenic Trail and hauling occurred during the summer so snowmobile trails were not affected.

Chappel

Soil and water resources – This area experienced nearly complete blowdown, making marking and reserve area layout challenging. The flagging that was used was overgrown by brush (and was difficult to see during salvage activities). It is recommended for future salvage operations with similar conditions that mapping of reserve areas be completed with a GPS unit to collect coordinates of reserve areas.

OGD subsequent to the salvage operation placed a road and diversion ditch within the unit that significantly modified area hydrology making it difficult to ascertain the effects of salvage harvesting. It also removed evidence of some skid trail patterns that were used for salvage activities and it was not possible to estimate the extent of soil disturbance. The units were cut throughout the winter of 2004-2005 and completed by the summer of 2005. If conditions became wet or soft, skidding operations were suspended until ground conditions improved. Consequently, skid trails observed were not rutted and did not affect future drainage.

Skid trail pattern and density were affected by the pattern of blowdown, areas with rock, and the slope of the area. Most of the blowdown fell as large swaths with trees stacked on top of one

another. There were no mapped group 2 or 3 soils in the unit, and skid trails were designated in the salvage area. Some winching was used to pull logs to skidders on designated skid trails.

A small seep was not buffered during the salvage operation. The seep was not indicated as a reserve area on the timber sale map and it was also not observed during layout and marking of the stand, likely due to the density and height (stacking) of the blown down trees. There was no evidence that equipment crossed the seep and it did not appear to be altered by the harvesting of blowdown.

A stream transitioning from ephemeral to intermittent was also observed within the blowdown area. An adequate buffer of 50 feet was applied to the stream, leaving no evidence of erosion or instability within the stream channel. Down trees were not removed within the stream buffer (Figure 39).

Figure 39. Photo taken from the center of riparian buffer along the stream channel within Chappel salvage sale

While the deliberate tipping of stumps was not practiced (SW8), some stumps did tip back upright when the bole of the tree was removed.

Vegetation resources – The units were surveyed for sensitive and invasive plants prior to implementation of the timber sale.

Residual overstory canopy in the stand was somewhat variable. Most of the area had less than 10 ft^2/acre of basal area standing, while areas around the edges contained up to an estimated 80 ft^2/acre of basal area standing, particularly along the eastern boundary. Overall, regeneration was poor throughout the unit with some aspen observed, an abundance of pin cherry on upslope positions, and heavy grasses and blackberry. It is recommended that the site be planted with quaking aspen, butternut, tulip poplar, basswood, and sugar maple. The site also needs to have interfering pin cherry, birch, beech and striped maple felled where they are overtopping desirable tree seedlings.

Natural seedling development was monitored through stocking surveys completed in fiscal years 2006, 2008, and 2010. Stocking survey data from FY 2010 indicated the stand contained 97% interfering vegetation, with 49% of the plots stocked with tree seedlings. Seedling stocking consisted of red maple, birch, black cherry, red oak, aspen, sugar maple, and ash. Birch, black cherry and red maple dominated the sapling size class. American elderberry, red elderberry, and serviceberry were also noted in the FY 2010 stocking survey. Interfering vegetation consisted of blackberry fern, grass, pin cherry, beech, and birch. This unit was evaluated for remedial reforestation activities in the Morrison Run project, including site preparation, herbicide application, planting, release, fencing and fertilization.

During harvest activities, portions of the unit were found to contain wet soils and were dropped, leading to volume discrepancies in this unit. Consequently, the sale ended up being a scaled sale with volume scaled at the mill.

Wildlife resources – Given the unit experienced complete blowdown, the marking of wildlife reserve areas did not persist, and subsequent construction of oil and gas roads through the unit made it difficult to determine whether wildlife reserve areas were implemented in the unit. However, some reserve areas in conjunction with water features were appropriately identified in the field, designated on the sale map, and avoided during salvage harvest activities. Some wet areas that were not identified during layout and buffered in reserve areas were subsequently identified during sale administration. These areas were dropped during sale administration and not salvaged. An area of larger boulders and rock outcroppings along the northwestern stand boundary was avoided entirely during layout of the unit.

There are no Indiana bat maternity colonies or roost trees known on the Forest and pre-implementation surveys did not document other threatened or endangered species or stick nests. The landing was located on an existing well pad and there was no need to reseed the landing. A native seed mix was used to stabilize trails. An abundance of snags, numerous live trees, and potential roost trees still standing were not salvaged. Trees with the tops snapped off or "cat-faced trees" were still standing and had not been harvested.

Social and heritage resources – The units were surveyed for heritage sites and cleared for layout and marking. Tree marking paint was applied on the side away from the road. There was no Concern Level 1 or 2 roads or trails associated with the unit. The landing was located on an existing well pad and there was no need for restoration. The unit was not located near an ATV trail, the North Country National Scenic Trail, or other non-motorized trails, and hauling occurred during the summer so snowmobile trails were not affected.

Conclusions and Recommendations – In future blowdown or broad scale mortality assessments, consider providing field crews with consistent thresholds to categorize damage. Possible thresholds for ocular estimates could be less than 10% of the canopy still intact (stand reinitiation blowdown), 10 to 40% intact (heavy blowdown, salvage, may need to remove some standing trees, follow up with reforestation treatments), 40 to 70% standing (moderately heavy blowdown - poorly to moderately well stocked stand will remain, consider area for two-step regeneration sequence), and more than 70% standing (relatively light blowdown, well stocked stand will remain, but follow up assessment recommended).

It is recommended that the Chappel site be planted with quaking aspen, butternut, tulip poplar, basswood, and sugar maple. The site also needs to have interfering pin cherry, birch, beech and striped maple felled where they are overtopping desirable tree seedlings.

Bench cut skid trails should be avoided due to the disturbance to soils and alteration of hydrology.

Where heavy and moderately heavy blowdown occurs, map reserve areas using a GPS unit that can record coordinates of reserve areas.

Prescribed burn smoke monitoring

Protocol – The ANF monitored smoke during two prescribed fires, one in FY 2012 and one in FY 2013. Smoke monitoring consists of photographic documentation, and the use of an E-Sampler (a nepholometer which quantifies light scattering) to measure $PM_{2.5}$. While the E-Sampler is not an EPA federal reference method instrument, it is a good tool to estimate the amount of fine particles in the air. The $PM_{2.5}$ benchmark that is used to estimate levels at which smoke would become a concern to human health is 35 µg/m^3 averaged over a 24 hour period.

Results – The Upper Millstone prescribed fire (Burn Unit A; 25-30 acres) occurred March 22, 2012, on the Marienville Ranger District. The E-Sampler was set up approximately 300-600 meters northeast of Upper Millstone Burn Unit A the day before the burn, in a predetermined safety zone. Figures 40 and 41 show light smoke shortly after initial ignition and Figure 42 shows a very light smoke plume from approximately 5 miles away. The 24-hour average $PM_{2.5}$ for the day of the fire was 5 µg/m^3.

Figure 40. Light smoke after ignition of Upper Millstone Burn Unit A prescribed fire (March 22, 2012, 1347 ET)

Figure 41. Light smoke after ignition of Upper Millstone Burn Unit A prescribed fire (March 22, 2012, 1349 ET)

Figure 42. View from Route 66 Marienville Fire Tower, approximately 5 miles west of Upper Millstone Burn Unit A prescribed fire (March 22, 2012, 1448 ET)

The Southwest Reservoir prescribed fire occurred May 3, 2013, on the Bradford Ranger District. The size of this fire was 161 acres in size. The E-Sampler was set up on the Kinzua Dam, less than 1¼ miles away from the fire from May 2 through May 7. This location was chosen to monitor any potential smoke inversion following the fire, along a public roadway, below the burn site.

The concentration of $PM_{2.5}$ from May 2-May 7 at the Kinzua Dam is shown in Figure 43. The time is given in Greenwich Mean Time (GMT) which is four hours ahead of Eastern Daylight Time (EDT). The high $PM_{2.5}$ concentration (23 µg/m^3) occurred at 2200 GMT (1800 EDT), on May 3, the day of the burn. The day of the burn 24-hour average was 4 µg/m^3. On May 4, 0100 GMT (2100 EDT on May 3), the concentration was 7 µg/m^3. The 24-hour average for May 4 was 3 µg/m^3.

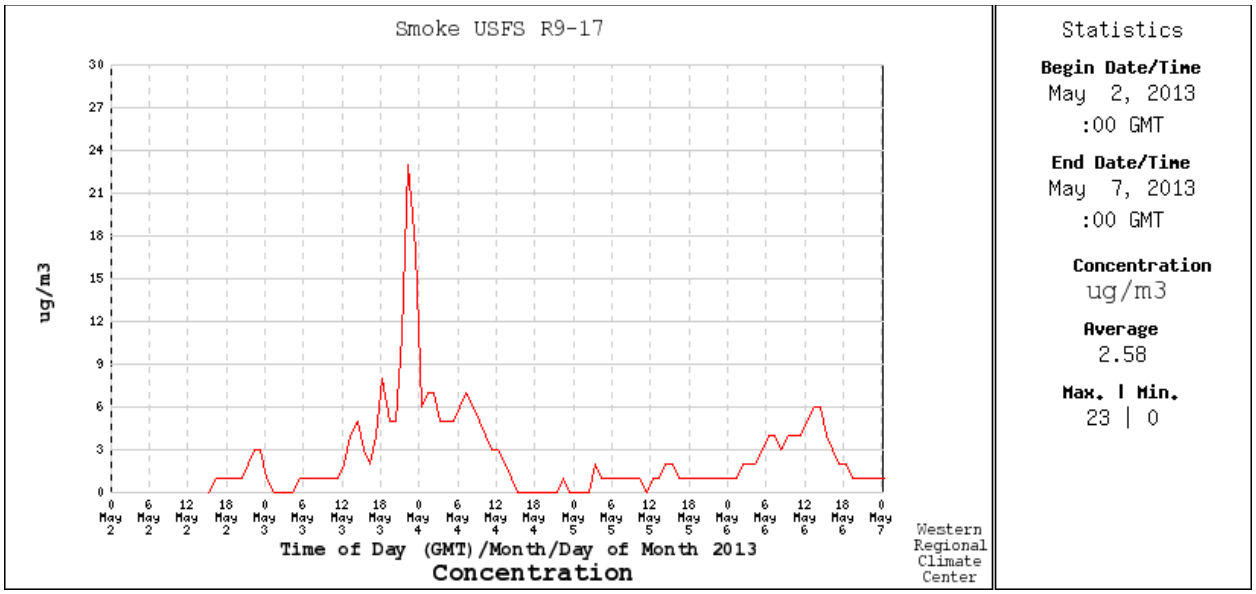

Figure 43. $PM_{2.5}$ concentration for May 2-May 7, 2012 (the Southwest Reservoir prescribed burn occurred on May 3, 2012)

Conclusions and Recommendations – Both the Upper Millstone and Southwest Reservoir prescribed burns remained well below the human health benchmark for $PM_{2.5}$. Continue smoke monitoring during selected prescribed burns.

National Best Management Practices monitoring

Protocol – A National BMP monitoring process was developed to ensure that activities on NFS lands are achieving water quality protection. In September 2013, an interdisciplinary team followed the Draft National BMP monitoring process for mineral exploration and production. They reviewed the Warrant 2921 shale gas well to determine if it was implemented as planned and whether BMPs were effective. The well pad had been constructed, but the well was not drilled because the operator was waiting for the water management plan to complete drilling and hydraulic fracturing. Since this well was drilled on private minerals, NEPA and 2007 Forest Plan standards and guidelines were not applicable.

Results and Conclusions – The Plan of Operations was implemented as planned, including construction of the site and implementing Erosion and Sedimentation Control Plans. It was determined that design of

well pad layout may have been improved if resource concerns, e.g., LiDAR modeled streams and research areas, had been provided to the company for their consideration during the planning process and layout.

Part of the well was near an aquatic management zone. The effectiveness evaluation found evidence of sediment transport to a wetland. The width of the aquatic management zone of 25 feet was found to be too narrow, which appears to have caused changes to algal growth in the wetland from the increased water temperature and light. In addition, the location of the infiltration/sedimentation basin discharged just upstream of this wetland. The drainage from the entire well pad is directed to this location through extensive rock-lined ditches. The impacts to this wetland may have been reduced if the water had been discharged away from this resource. The impacts appear at this time to be minimal and beneficial uses were not being impacted. There was no evidence of hazardous chemicals, leachates, human trash or human waste.

Recommendations

- Provide companies with information on resource concerns to consider during planning process and layout. This exchange of information was actually occurring with two of the larger oil and gas operators on the Forest around the time of this review.
- To reduce the changes in water temperature around the wetland, trees should be planted to provide shade around the wetland.
- Instead of controlling all the site drainage at one infiltration basin, it may be better to distribute the outflows over multiple locations.

Achievement of Forest Plan Objectives

Land and Resource Management Planning

Develop an Allegheny Reservoir management plan

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Complete a management plan for the area surrounding the Allegheny Reservoir including that portion of the National Recreation Area.	Has a management plan been created for the area surrounding the Allegheny Reservoir including that portion of the National Recreation Area?	Annual	5 years	A

Protocol – Information collected during the FY 2010 National Visitor Use Monitoring (NVUM) process along with the FY 2008 Recreation Facility Analysis (RFA) would be used to develop a management plan. Resource condition assessments and a monitoring protocol would be developed as part of the management plan.

Results – No management plan has been completed.

Conclusions and Recommendations – Continue to work with Pennsylvania Kinzua Pathways along with other potential partnership opportunities to develop a management plan. Utilize the FY 2008 RFA and information collected during the FY 2010 NVUM process as well as information that will be collected during the FY 2015 NVUM process. Also utilize information developed in private concessionaires' annual Operation and Maintenance Plans for developed recreation areas.

Noxious Weeds

Establish seed and mulch mixes that limit spread of invasive species

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Collaborate with other agencies/entities to establish seed and mulch mixes appropriate to limit introduction and spread of invasive species for use on the ANF.	Have seed and mulch mixes been established for the ANF that will limit the spread of invasive species?	5 years	5 years	A

Protocol – Forest Service Manual 2070 Vegetation Ecology, Forest Service Manual 2900 Invasive Species Management.

Results – ANF staff have reviewed seed mix recommendations from the Ruffed Grouse Society and the Pennsylvania Biological Survey's Vascular Plant Technical Committee developed for use on oil and gas sites being developed on private and state forest lands. Some species have been included in a couple test locations on the ANF.

Conclusions – Efforts have been made to change species in former seed mixes used on the ANF that contained non-native invasive species. There is a need for continued study of these mixes and monitoring.

Recommendations – There is a need to refine seed mixes for timber sales and road work so that desirable cover is met. Continue working with Timber Sale Administrators and Engineering staff. Work with native seed suppliers to produce genetically appropriate seed that is readily available for use on the ANF.

Treat invasive plants

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Complete invasive plant treatments to lessen their impact on native plant communities on 300 to 600 acres, annually.	How many acres of invasive plant treatment have occurred?	Annual	5 years	A

Protocol – The protocol for the survey of NNIP is found in USDA-FS 2014a.

Results – A total of 622.2 acres of NNIP were treated across the ANF from FY 2008 through FY 2013. This equates to an average of 103.7 acres treated annually (Table 31). Treatments were accomplished via stewardship contracts, ANF staff, FCI McKean prison crew, YCC, and student interns. Some of the species treated included: garlic mustard (*Alliaria petiolata*), goatsrue (*Galega officinalis*), multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thungbergii*), exotic bush honeysuckles (*Lonicera* sp.), glossy buckthorn (*Frangula alnus*), Japanese knotweed (*Fallopia japonica*) and purple loosestrife (*Lythrum salicaria*).

Table 31. Acres of non-native invasive plant treatment (FY 2008-2013).

Management Activity	FY08	FY09	FY10	FY11	FY12	FY13	Total
Manual/mechanical treatment for non-native invasive plant species	28.1	21.1	33.2	28.1	99.7	265.3	475.5
Herbicide treatment for on-native invasive plant species	0	0	0	25.6	92.9	28.2	146.7
Total	**28.1**	**21.1**	**33.2**	**53.7**	**192.6**	**293.5**	**622.2**

Conclusions – Herbicide use for NNIP Treatment was analyzed and approved under the 2007 Forest Plan. It took three years to move from planning in subsequent project-level environmental analyses to implementation in order to treat NNIP with glyphosate, one of the two approved herbicides under the

Forest Plan, the other being sulfometuron methyl. Through the use of stewardship contracting, NNIP treatment acres have increased in the last two years and it is anticipated that stewardship authority will be used more extensively in the future for NNIP treatment.

Recommendations – There is a need to analyze additional chemicals and treatment methods to effectively conduct NNIP treatment, e.g., use of basal bark treatment for glossy buckthorn. Additionally, there are MAs on the ANF that have not been included in project-level analyses and are not anticipated to be included in the near future in which NNIP treatment is needed, e.g., west side of the Allegheny Reservoir.

Recreation

Manage concentrated use areas to prevent resource damage

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Increase the number of inventoried dispersed sites and concentrated use areas (CUAs) managed to standard to reduce health, safety, and resource impacts caused by unmanaged recreation use in the general forest area. Provide ancillary support facilities, such as parking areas and toilets, as needed, to protect resources and the environment.	Are dispersed sites and CUAs being managed to prevent resource damage?	Annual	3 years	B

Protocol – During project-level planning, concentrated use areas (CUAs) are inventoried and evaluated allowing for a decision to be made as to whether dispersed sites should be kept, closed, or rehabilitated.

Results – Since FY 2007, areas along the Clarion River as well as within the Southwest Reservoir, Upper Kinzua, Sugar Run, Salmon West, Millsteck, and Pine Bear projects have undergone extensive inventorying accompanied by the decision to close numerous dispersed sites and keeping/rehabilitating many others. Rehabilitation of sites has involved providing hardened parking areas, installing vault toilets, installing natural barriers (rocks, earthen mounds, native plantings) and implementation of a numbering system to allow for more effective forest patrols by Forest Protection Officers (FPOs) and Law Enforcement Officer's (LEOs).

Conclusions and Recommendations – Continue to inventory and evaluate dispersed sites during project-level planning. Continue to utilize FPO and LEO patrols in areas where investments have been made to prevent overcrowding during peak seasons, minimize health and safety concerns, and resource degradation.

Manage for recreation opportunity spectrum settings

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage for desired Recreation Opportunity Spectrum (ROS) settings as indicated in each management area's desired condition description.	Are desired ROS settings being achieved?	5 years	5 years	B

Protocol – The Recreation Opportunity Spectrum (ROS) is a system for classifying and managing recreation opportunities based on the following criteria: physical setting, social setting, and managerial setting. Potential impacts to these criteria are used to determine if proposed activities are consistent with the established ROS setting.

Results – With the implementation of Forest Plan design criteria and project-specific mitigation measures, all proposed project activities have met established ROS settings.

Conclusions and Recommendations – Continue to use ROS as a primary indicator for measuring effects in project-level recreation analysis.

Wilderness Areas

Manage wilderness areas to meet Wilderness Stewardship Challenge

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage designated wilderness areas to meet the minimum level of stewardship described in the 2006 Chief's 10-year Wilderness Stewardship Challenge.	Are the following stewardship elements being addressed: fire, noxious/invasive plants, air quality, education, recreation use impacts, outfitter/guides, opportunities for solitude or primitive and unconfined recreation? Are wilderness areas being managed to standard?	2 years	5 years	B

Protocol – The 10-Year Wilderness Stewardship Challenge was developed by the Chief's Wilderness Advisory Group (WAG) as a quantifiable measurement of the Forest Service's success in wilderness stewardship. The goal identified by the WAG, and endorsed by the Chief, is to bring each and every wilderness under Forest Service management to a minimum stewardship level by the 50th Anniversary

of the Wilderness Act in 2014. The first year of the Challenge was FY 2005. Wilderness managers are required to report annually on their level of achievement of meeting the 10 elements of the Challenge.

Results – The ANF has met the minimum stewardship levels of the Challenge in the last five years by meeting eight of the 10 elements. A summary of the status of each element follows:

1. Fire – A wilderness checklist for fire management has been prepared.
2. Noxious/invasive plants – Volunteers, including Friends of Allegheny Wilderness (FAW), scout groups, church groups, and school groups have identified, GPS/GIS mapped and eradicated areas of NNIP. They also monitored vegetation for evidence of insect and disease.
3. Air Quality – Ozone biomonitoring data have been collected on the ANF for over a decade. The Wilderness Stewardship Challenge: Air Quality Values Monitoring Plan (USDA-FS 2014b) recommends that ozone biomonitoring continue, as the data are representative of the health of the ozone-sensitive vegetation in the wilderness areas (see *Destructive insects and diseases – ozone* section). The Wilderness Stewardship Challenge: Air Quality Values Monitoring Plan also recommends supplemental monitoring including water quality monitoring and fish surveys in the Hickory Creek Wilderness Area, and a risk assessment for mercury contamination in both the Hickory Creek and Allegheny Islands Wilderness Areas.
4. Education – Interpretive panels, signs and brochures can be viewed and are distributed at trailheads, boat launches, and ANF offices and web page. "Leave No Trace" programs are presented by FAW and ANF employees to groups both on- and off-Forest. FAW and seasonal employees engage with wilderness visitors on summer weekends and holidays.
5. Protect Opportunities for Solitude or Primitive and Unconfined Recreation – FAW and seasonal employees monitor and evaluate wilderness and wilderness transition zones for evidence of human activities, such as litter, campfires, and motorized/mechanized use. They remove evidence of geocaches, hunter trails and stands and discourage large-group use. FAW has sponsored seedling planting events to transition old right-of-way and foot path areas back to vegetated forest areas. FAW also maintains the Hickory Creek Wilderness Trail through sponsored weekend events each spring and fall. FAW is currently sponsoring a photo contest through the local Crary Museum in Warren, Pennsylvania, to commemorate the 50th Anniversary of the Wilderness Act.
6. Complete Recreation Site Inventory – A recreation site inventory (using the recreation site monitoring protocol) lead by seasonal employees, FAW and student volunteers is 30% complete for the Hickory Creek Wilderness and 10% complete for the Allegheny Islands Wilderness.
7. Outfitter Guides Model Appropriate Wilderness Practices – Annual Outfitter Guide Operation and Maintenance Plans include "Leave No Trace" language and brochures given to clients using the Allegheny River and Allegheny Islands Wilderness.
8. Adequate Direction in Forest Plan to Prevent Degradation of Wilderness Resource – See the Forest Plan (USDA-FS 2007a, pp. 116-120).
9. Priority Information Needs have been Addressed Through Field Data Collection, Storage and Analysis – Collected, stored and analyzed data (air quality, campsite inventory, NNIP, insect/disease, illegal activities, and visitor use) have helped determine where, when, and how limited personnel and educational resources are expended.
10. Wilderness has Baseline Workforce in Place – Seasonal employees spend at least one weekend day in the Hickory Creek Wilderness or observing Wilderness Islands on the Allegheny River throughout the summer months. Visitor information services personnel advertise and promote

wilderness through distribution of written, verbal, and web page information. LEO/FPO patrol the perimeter of the areas. Trailhead parking lots are plowed in the winter season as needed.

Conclusions and Recommendations – Wilderness Stewardship Challenge minimums could not have been met without the help of dedicated volunteers and seasonal employees. Volunteers will continue to be a big part of the Wilderness Stewardship Program. FAW will continue to help manage wilderness through their educational, planting, trail maintenance, campsite inventory, NNIP, and insect/disease efforts. Seasonal employees and student volunteers will continue efforts to inventory campsites and discourage illegal uses. ANF personnel should explore the opportunity to work with University of Pittsburgh at Bradford students to develop a wilderness education resource guide (pre-trip, field trip, and post-trip activities) for middle school teachers/students. Implement the Wilderness Stewardship Challenge: Air Quality Values Monitoring Plan recommendations.

Trails

Establish trail classes, permitted uses, and construction/reconstruction/ maintenance priorities

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
For all trails, establish trail classes, permitted uses, construction, reconstruction, and maintenance priorities.	Have trail classes and permitted uses been established? How many miles of trail (per trail type) have been constructed or reconstructed? Have maintenance and construction priorities been established? Are trails constructed and maintained to standard? Have limited use trails been converted to sustainable multiple use trails based on compatible uses and resource constraints?	Annual	5 years	A

Protocol – A formal and detailed monitoring effort occurs through the Forest Service inventory control system known as INFRA. As resources allow, all trails receive an informal inspection once annually and after major storm events. Trail use is monitored as resources allow through trail counters, parking lot counts, and record keeping of visual observations by Forest staff and volunteers.

Results – Trail planning has identified trail classes and permitted uses as well as maintenance and construction priorities. Trail classes and permitted uses are documented in the Trails Management Objectives section of INFRA Trails. Annual trail construction, reconstruction, and/or maintenance

mileage (completed through user-generated funding, contractor and/or volunteer) is reported through priority of work accomplishment reporting and in INFRA. Information on miles of trail (per trail type) can be found in INFRA Reports. Recent or newly planned/constructed trails have been created through user-group proposals and are connectors to existing infrastructure and or desired services, i.e., such as, gasoline, food, lodging, etc. New trail planning, design and/or construction does not occur without written cooperative agreements with trail groups to help fund, plan, design, construct, and pledge to long-term maintenance of the trail. Trail maintenance is accomplished through volunteers and hosted program personnel, e.g., SCA, YCC, and FCI McKean Prison Crew. The ANF does not have limited use trails suitable for conversion that have not already been converted to multiple use trails.

See also *Comparison of projected and actual outputs and services – Recreation activities*, *Facilitate regular grooming of snowmobile trail system*, and *Develop and design equestrian trails for equestrian use*.

Conclusions and Recommendations – Continue to maintain existing trails through volunteer and cooperative group agreements along with hosted program personnel (SCA, YCC, FCI-McKean Prison Crew). Only consider new trail construction proposals from sponsored groups who wish to connect ANF land to services that would benefit Forest trail users. Those groups must be willing to help support and fund the planning, design, construction, and long-term maintenance of new trails. Utilize information collected in FY 2015 NVUM process to verify Forest trail use.

Evaluate ANF road system suitable for snowmobile use

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Evaluate ANF road systems to identify which roads are suitable for snowmobile use utilizing the Travel Management Process.	Are roads and trails designated for snowmobile use marked and signed?	Annual	Annual	B

Protocol – Regulations governing motor vehicle use on National Forests and Grasslands have been established under the 2005 Travel Management Rule (36 CFR Parts 212, 251, 261, and 295 Travel Management; Designated Routes and Areas for Motor Vehicle Use; Final Rule*).*

The CFRs make a distinction between 'motor vehicles' and 'over the snow vehicles'. Travel management planning is required by each National Forest and Grassland for motor vehicles but is optional for over the snow vehicles. The final rule prohibits the use of motor vehicles off a designated system road, as well as use of motor vehicles on routes and in areas that is not consistent with the designations.

The clear identification of roads, trails, and areas for motor vehicle use on each National Forest will enhance management of NFS lands; sustain natural resource values through more effective management of motor vehicle use; enhance opportunities for motorized recreation experiences on NFS lands; address needs for access to NFS lands; and preserve areas of opportunity on each National Forest for non-motorized travel and experiences. The final rule is consistent with provisions of Executive Order 11644 and Executive Order 11989 regarding off-road use of motor vehicles on Federal lands.

Even though over the snow vehicles are exempt from mandatory designation, restrictions or prohibitions may be proposed following the procedures included within the body of 36 CFR 212, subpart B, including public involvement, coordination with governmental agencies, revision of designations, and application of criteria in 36 CFR 212.55. The ANF used the procedures outlined in 36 CFR 212.55 to evaluate additions to the snowmobile trail system.

Results – Roads and trails designated for snowmobiles are found on the 2012 Snowmobile Trails Map. This map meets the requirement of 36 CFR 212.55 to publish an over the snow map. In partnership with the Pennsylvania State Snowmobile Association, the snowmobile trail system was marked and signed in FY 2013.

Conclusions and Recommendations – The Forest is required by law, in the Travel Management Rule, to evaluate and update a motor vehicle use map on an annual basis. The Forest will also adhere to any changes and/or new directives regarding travel management planning for off-highway vehicles, including over the snow vehicles. Specific to over the snow vehicles, the Forest will continue to maintain a Snowmobile Trails Map to show where it is legal for the public to ride.

Facilitate regular grooming of designated snowmobile trail system

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Facilitate regular grooming of the designated snowmobile trail system if Commonwealth funding is available.	To what degree has the ANF contributed to snowmobile grooming?	Annual	Annual	B

Protocol – Recreation personnel along with the grooming contractor develop a weekly grooming schedule dependent upon weather conditions. The grooming contract administrator keeps track of how much time is spent grooming trails in order to help determine overall accomplishment and program of work in the recreation program. An annual accomplishment report details what trails were groomed and what efforts were made to facilitate regular grooming.

Results – From FY 2008 to FY 2013 two Forest Service snow grooming machines were used for grooming trails across the entire Forest at least twice a week when conditions were favorable (109.39 miles of the Allegheny Snowmobile Loop and 78.09 miles (29%) of the 269.06 miles of connector trails on the ANF). A Challenge Cost Share Agreement continued with the Forest County Snowmobile Club to groom an additional 34.58 miles (13%) of connector trails on the Forest. In addition to this agreement, two Challenge Cost Share Agreements were developed with the Tionesta Valley Snowmobile Club and the Marienville Trail Riders Snowmobile Club to groom 8.33 (3%) and 55.06 miles (20%) of connector trails, respectively.

Conclusions – Groomed trail mileage varied from year to year depending on the amount of snow and equipment function. For FY 2008 to FY 2013, the Forest met the objective of regular trail grooming.

Recommendations – Continue to seek out long-term maintenance projects with volunteers to provide quality grooming results.

Design and develop equestrian trails for equestrian use

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Inventory and assess equestrian user developed trail systems within Equestrian Use Areas (EUAs). Incorporate appropriate trail segments and make connections to create designated trail systems where feasible. Eliminate trail systems or segments where resource standards cannot be met.	Have equestrian trails been designed and developed for equestrian use?	Annual	3 years	B

Protocol – Two methods were primarily used to document impacts from user-developed trails and develop recommendations for designation of primary trails.

The first method, the condition class system (Leung et al. 2006), utilized a standardized condition class rating form in which four descriptive condition classes were used. Routes were divided into segments for recording width, depth, length, slope, aspect, and vegetation type. A management recommendation based on professional field observation was made on each user-developed route. The recommendation identified whether the user-developed route would be considered further for designation as a primary trail. Maps were generated showing existing user-developed trails and coded to reflect the management recommendation and condition class.

In addition to the condition class system, recreation personnel also inventoried user-developed trails on the Forest. Photos were taken at established photo points and a local site map illustrating the route and landmarks were drawn to assist with future relocation and resource damage monitoring. Recreation staff worked cooperatively with various clubs and ranches to monitor resource impacts.

Results – Thirty-eight miles of the Spring Creek Horse Trail were newly constructed in FY 2012 and FY 2013 in Forest and Elk Counties.

Conclusions and Recommendations – Pursue potential opportunities for new horse trails and maintenance and expansion of the Spring Creek Horse Trail as they are presented.

Provide snowmobile system connectors

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Utilize partnerships with snowmobile clubs, local communities, State agencies, and private landowners to provide snowmobile system connectors across private lands to Tionesta, Ridgway, Sheffield, and Bradford.	What connectors have been developed?	Annual	Annual	A

Protocol – See protocol described under *Evaluate ANF road system suitable for snowmobile use*.

Results – No new connectors were built.

Conclusions and Recommendations – Pursue potential opportunities as they are presented.

Heritage

Develop management plans for preservation of cultural resources

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Develop management plans for the long-term preservation of heritage resources that are either listed on or eligible for the National Register of Historic places.	How many management plans have been completed?	Annual	5 years	A/B

Protocol – This is an accomplishment accounting question that can be answered by addressing how many management plans were developed for eligible and potentially eligible sites.

Results – No management plans were developed for any of the eligible and potentially eligible sites on the ANF between FY 2008 and FY 2013.

Conclusions – Progress on this objective was not made due to the Heritage Program Manager/Forest Archaeologist position being vacant, and the absence of a staff member who could complete a heritage management plan for Forest cultural resources.

Recommendations – The Heritage Program Manager/Forest Archaeologist position was filled at the beginning of FY 2014. Since then, portions of a Heritage Management Plan have been created and additional sections are being developed. It is recommended that this progress continue.

Evaluate heritage sites

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Reduce the backlog of heritage sites that require evaluation and nomination to the National Register of Historic Places.	How many evaluations have been completed? How many heritage resources have been nominated?	Annual	5 years	A

Protocol – The National Register of Historic Places Criteria for Evaluation was used to evaluate sites and determine if nomination was warranted.

Results – Thirty-nine sites were evaluated between FY 2008 and FY 2013 and one site was nominated for the National Register of Historic Places. However, this site was nominated by the Pennsylvania

Department of Transportation and not the Forest Service. Although this has reduced the backlog in sites, it is only a small percentage of the unevaluated sites on the Forest.

Conclusions – The lack of backlog reduction is due to insufficient funding for heritage-specific projects and tasks, and the fact that heritage personnel have not been able to focus on them for any amount of time. As a support program, the heritage unit struggles to balance compliance work conducted for other Forest programs with strictly heritage projects.

Recommendations – To reduce the backlog of heritage sites that require evaluation for the National Register of Historic Places, the ANF will need to provide greater funding for the heritage program. This funding can be used to either hire additional staff or use it to hire contractors to complete the evaluations for the Forest.

The difficulty of balancing compliance and heritage-specific projects is common across all of the Forest Service. This imbalance led to the introduction of the Heritage Program Managed to Standard accounting standards. With this, compliance projects can no longer be counted as heritage program accomplishments and yearly targets are comprised of heritage-focused projects that are scored on a point system. Nationally, a minimum score is 46. However, the Eastern Region of the Forest Service (Region 9) set the minimum score at 35 last year, a score that the ANF heritage program attained. To date in 2014, the ANF is on track to meet, and potentially exceed, the national minimum score.

Despite the inability to focus on heritage-specific projects and tasks, examination of project-support activities over the last six years illustrates that a considerable amount of work has been accomplished. Over the last six years, approximately 9,000 acres have been surveyed, 124 new sites found, 41 sites have been evaluated, 48 sites have been monitored, and eight interpretive projects have been completed.

Develop inventory of culturally sensitive sites with Seneca Nation of Indians

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Work with appropriate representatives of the Seneca Nation of Indians (SNI) to develop a confidential inventory of culturally sensitive sites.	Has an inventory of SNI culturally sensitive sites been established?	Annual	5 years	A

Protocol – Consultations are held with representatives of the Seneca Nation of Indians (SNI) to develop an inventory of culturally sensitive sites by exchange of information.

Results – An inventory has not yet been developed. Two formal consultation meetings occurred between the Forest and the Seneca Nation of Indians (SNI) between FY 2008 and FY 2013. The initial meeting was in 2008 regarding the Ridgeview-Cordyon Cemetery. The SNI and ANF met to discuss the erosion at the Cemetery, caused by the Allegheny Reservoir. As a result of this and additional discussions, the USACE was made to provide protection to the Cemetery and prevent further erosion of it into the Reservoir.

The second consultation meeting held during this period was on June 20th, 2012, to introduce the new Forest Supervisor as well as discuss the relicensing of the Kinzua Dam under the Federal Energy

Relicensing Commission; the Forest's Programmatic Agreement; the SNI's interest in the Youth Conservation Corps Program; and OGD on the Forest, specifically the Marcellus Shale developments.

Although only two formal meetings occurred between the ANF and SNI from FY 2008 through FY 2013, prior to and during these years there was consultation between the District Archaeologists and the SNI regarding project work.

Conclusions – The lack of heritage program staff throughout the last several years has resulted in few formal Forest-wide interactions with the SNI. With the Heritage Program Manager/Forest Archaeologist position now filled, greater advances will be made in working with the SNI to develop this inventory.

The ANF met with six members of the SNI on March 23rd, 2014, including Tribal Archaeologist Jay Toth, to discuss possible programs and greater interaction with the SNI. The SNI would like to explore working with Forest silviculturists to identify black ash seed trees and develop a program that will allow them to collect black ash seeds to be planted on the reservation in an effort to give tribal members greater access to ash trees for basket making. The SNI have also discussed the conservation of white oak trees that are 100 years old or greater, and have expressed a desire for them to be excluded from timber sales.

The most recent meeting also allowed the SNI to share their desire to work with the Forest Botanist to identify locations where traditional medicinal plants grow within the ANF. The program would aim to document and map these locations and make this information available to SNI peoples who would like to collect them for personal use. Two additional goals of the program would also be to develop a system to track (e.g., issue permits) the use and collection of these resources, as well as protect them from disturbance during timber sales.

Recommendations – It is recommended that the Forest continue to foster its relationship with the SNI by continuing to consult with them on specific projects and hold yearly meetings with the SNI, the Forest Supervisor, and the Heritage Program Manager.

Scenery

Maintain or exceed scenic integrity levels

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maintain or exceed adopted Scenic Integrity Levels (SILs) as seen from Concern Level 1 and 2 travel routes and use areas.	Are we meeting or exceeding SILs?	5 years	5 years	B

Protocol – Scenic Integrity Level (SIL) is used as a primary indicator for measuring effects of proposed project activities, i.e., an Indicator Measure of whether the activities proposed in each project alternative would meet the established Forest Plan SIL of the area as seen from Concern Level (CL) 1 or 2 view facilities.

Results – With the implementation of Forest Plan design criteria and project-specific mitigation measures, all vegetation management project activities have met established SILs from CL 1 or 2 view facilities.

Not all OGM developments have met SILs from CL 1 or 2 view facilities.

Conclusions and Recommendations – The ANF uses the protocol discussed in the *Identify resource concerns associated with oil and gas development* section to avoid, mitigate, and resolve resource concerns associated with OGM development. The ANF may negotiate mitigation measures with operators which are consistent with 2007 Forest Plan standards and guidelines; however, it is not always possible to meet SIL objectives as Notices to Proceed associated with outstanding and reserved mineral development are being evaluated under 1986 Forest Plan standards and guidelines. See also *Oil and gas developments meeting Forest Plan design criteria*.

While Forest Plan design criteria and project-specific mitigation measures have been implemented, effectiveness monitoring has not been conducted to determine if SILs from CL 1 or CL 2 view facilities have been maintained post implementation. It is recommended that monitoring is conducted from a sample of implemented vegetation management projects to evaluate the effectiveness of design criteria and project-specific mitigation measures in meeting SIL objectives.

Continue to use SIL as a primary indicator for measuring effects in project-level scenery management analysis.

Maintain existing and construct new scenic vistas

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maintain existing scenic vistas and construct five additional vistas.	Are scenic vistas being maintained? How many additional vistas have been constructed?	5 years	5 years	A

Protocol – Recreation personnel conduct a visual inspection of existing scenic vistas.

Results – Between FY 2008 and FY 2013 the Rimrock, Jakes Rocks, Kinzua Point Information Center (KPIC), FR 262 (Elijah Run View), FR 492 (View of Morrison Bridge) and Sugar Bay scenic vistas were maintained. No new additional vistas have been constructed.

Conclusions and Recommendations – Pursue potential partnership opportunities to help maintain existing scenic vistas. Continue to look for potential new scenic vista opportunities in planned projects.

Vegetation

Provide vegetative diversity

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Provide vegetative diversity across the landscape by providing a diversity of age classes, including late structural and multi-age conditions, to achieve desired future conditions.	How does the diversity of age classes and structural conditions compare to plan objectives?	Annual	5 years	A/B

Protocol – Structural stages were summarized using vegetation data in the Field Sampled Vegetation (FS Veg) database. Age class information was used as an overall proxy for structural stage, similar to those used in the Forest Plan FEIS (USDA-FS 2007b).

Results – Table 32 summarizes desired structural stages (USDA-FS 2007a, p. 19) and age classes (USDA-FS 2007b, p. 3-137) projected for Decade 1 of Forest Plan implementation compared to present conditions.

Table 32. Desired and present condition for structural stage (age class) distribution (percentage of the ANF)

Structural Stage (Age Class)	Desired Condition Decade 1*	Present Condition 2013*
Early Structural (dominant tree layer <5 inches DBH; 0-20 years old)	8%	3.4%
Mid Structural (dominant tree layer 5-20 inches DBH; 21-110 years old)	72%	76.3%
Late Structural (dominant tree layer ≥ 20 inches DBH; ≥ 111 years old)	10%	10.3%

*Note: Both Forest Plan projected and 2013 present condition totals do not add up to 100%. The remainder is non-forest or developed land condition.

Conclusions – Desired ecosystem conditions for the Forest include sustaining a diversity of vegetative structural stages and age classes across the landscape. Early structural stages created by timber harvest or natural disturbance were projected to comprise 8-10% of the forested landscape (USDA-FS 2007a, pp. 11 and 19). Presently, approximately 3.4% of the ANF, or less than half of that desired, is in an early structural condition (less than 20 years old). This acreage (17,754 acres) represents approximately 4.7% of the total suitable forestland on the ANF.

Even-aged regeneration harvests, or final harvests, typically follow shelterwood seed cuts and reforestation treatments, and occur once adequate tree seedlings have become established. There are several reasons that final harvests sold are below levels projected in the Forest Plan. These include: the number of shelterwood seed cuts initially prescribed; interfering vegetation that must be treated to promote tree seedling establishment; more sporadic and less abundant seed crops for some tree species; poorly distributed seed trees where mortality or windthrow has impacted overstory tree stocking; and

inadequate tree seedling establishment. Additionally, poor timber markets in recent years have slowed harvest rates for shelterwood seed cuts that have been sold or are under contract, delaying subsequent reforestation treatments and final harvests. Funding and staffing levels on the ANF determine the degree to which Forest Plan objectives and desired conditions are achieved.

In the longer term, if even-aged and uneven-aged regeneration harvests continue to be lower than the stated objectives, landscape-level desired vegetative structural stages and age classes will not be sustained at levels sufficient to meet desired Forest Plan ecosystem conditions. In fact, the longer implementation rates are below those listed in Forest Plan objectives, the more skewed age class distribution will become.

Recommendations – It is recommended to increase regeneration treatments on the ANF in order to move forest age class and structural stage distribution toward desired conditions in the Forest Plan.

Maintain or create age class diversity

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maintain or create age class diversity on lands suitable for timber management to provide for sustainable forest ecosystems and high quality hardwood timber products by treating an estimated 1,400 to 1,800 acres using even-aged regeneration methods and treating 300 to 700 acres using uneven-aged methods, annually.	How many acres of even-aged regeneration harvest and uneven-aged harvest have occurred?	Annual	Annual	A

Protocol – Vegetation harvests sold for even and uneven-aged regeneration were compiled from vegetation databases, including TIM and FACTS databases. Single tree uneven-aged harvests were not included in this evaluation as they generally are designed to transition even-aged stands to an uneven-aged structure and are intended to be followed up with a group selection harvest. Single tree selection harvests typically do no create large enough canopy gaps to serve as early successional habitat, nor do they change age class diversity. Group selection uneven-aged harvests were included in this evaluation as they result in small areas of young forest that serve as a type of early successional habitat.

Results – Table 33 summarizes even-aged and uneven-aged regeneration harvests sold between FY 2008 and FY 2013.

Table 33. Acres of regeneration harvests sold (FY 2008-2013)

	Type of Even-aged Final Harvest (acres)					
Fiscal Year Sold	**Clearcut**	**Overstory Removal**	**Shelterwood Removal Cut**	**Two-aged Final Removal Harvest**	**Total Even-aged Harvest**	**Total Uneven-aged Harvest (Group Selection)**
2008	0	0	157	0	**157**	**34**
2009	15	0	148	69	**232**	**32**
2010	0	0	581	101	**682**	**40**
2011	0	0	534	53	**587**	**0**
2012	0	0	454	80	**534**	**0**
2013	0	8	631	32	**671**	**0**
Total	**15**	**8**	**2,505**	**335**	**2,863**	**106**

In total, 2,863 acres were sold for even-aged regeneration (includes areas regenerated to one or two age classes) and 106 acres were sold for uneven-aged regeneration (three or more age classes) between FY 2008 and FY 2013. This equates to 477 acres of even-aged regeneration and around 18 acres of uneven-aged regeneration harvests sold annually in order to maintain or create age class diversity.

These figures include fifteen acres of clearcutting to create early successional habitat for wildlife and regenerate aspen. In order to sustain greater within-stand structural diversity and maintain two age classes on the site in the long term, 335 acres were sold for two-aged final harvests (see *Comparison of projected and actual outputs and services*).

Conclusions – Desired ecosystem conditions for the Forest include sustaining a diversity of vegetative structural stages and age classes across the landscape, within the context of multiple use management. To provide desired ecosystem conditions, Forest Plan objectives include maintaining or creating age class diversity of lands suitable for timber management by annually treating 1,400 to 1,800 acres using even-aged regeneration methods, and 300 to 700 acres using uneven-aged methods (USDA-FS 2007a, p. 19).

The first six years of Forest Plan implementation resulted in final even-aged regeneration harvests that will create age class diversity at about 34% of the rate of the associated Forest Plan objective. Uneven-aged regeneration harvests sold in the first six years of Forest Plan implementation achieved around 6% of the of the associated Forest Plan objective. These harvests have been less than projected in the Forest Plan for the reasons mentioned under *Provide vegetative diversity*.

In the longer term, if even-aged and uneven-aged regeneration harvests continue to be lower than stated objectives, landscape-level desired vegetative structural stages and age classes will not be sustained at levels sufficient to meet desired Forest Plan ecosystem conditions. In fact, the longer implementation rates are below those listed in Forest Plan objectives, the more skewed age class distribution will becomes.

Recommendations – It is recommended to increase regeneration treatments using even-aged and uneven-aged methods in order to move toward achieving Forest Plan objectives, as funding and staffing permit. Continue monitoring progress towards achievement of desired vegetation conditions.

Conduct pre-commercial thinning or release in regenerated stands

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Conduct pre-commercial thinning or release in regenerated stands to maintain species diversity, favor desired species, and improve health, vigor, and growth on 500 to 2,500 acres, annually.	How many acres have been treated with pre-commercial thinning or release?	Annual	Annual	A

Protocol – Acres of pre-commercial thinning and release implemented between FY 2008 and FY 2013 were compiled from the FACTS database.

Results – Pre-commercial thinning and release treatments are implemented to maintain species diversity, and improve health, vigor, growth and quality in young forest stands. In total, 2,955 acres received release or pre-commercial thinning treatment between FY 2008 and FY 2013 resulting in an average of 492 acres annually. Over 73% of these treatments consisted of area release, which typically occurs in young stands less than 15 years old. Area release involves removal of competing saplings across an area to increase competitiveness of desirable species in order to enhance long term species diversity.

Forest Plan objectives include conducting pre-commercial thinning or release treatment in regenerated stands on 500 to 2,500 acres annually (USDA-FS 2007a, p. 19). Overall, pre-commercial thinning and release treatments were just below the low end of average annual Forest Plan projections (see *Comparison of projected and actual outputs and services*). This is primarily because less final harvesting occurred in the past six years than projected in the Forest Plan.

Conclusions – Forest Plan goals include providing a diversity of vegetation species or forest types to achieve multiple resource objectives and sustain ecosystem health (USDA-FS 2007a, p. 14). Release and pre-commercial thinning treatments implemented so far help sustain tree species composition and diversity in young stands, thereby helping provide a diversity of vegetation species and forest types across the landscape.

Recommendations – Continue monitoring composition, diversity, and competitive interactions of tree species in young stands to assess the need for release or pre-commercial thinning activities. Continue monitoring progress toward achievement of young stand tending activities, such as release and pre-commercial thinning.

Use prescribed fire to enhance ecosystem resiliency

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Use prescribed fire to enhance ecosystem resiliency, conserve fire-adapted plant and animal biodiversity, and maintain and restore mixed oak ecosystems on 75 to 400 acres, annually.	How many acres have been treated with prescribed fire?	Annual	5 years	A

Protocol – All of the areas treated with prescribed fire were conducted in the spring time, primarily March, April, and May. In the early part of the spring, projects containing warm season grasses are implemented with the objective of reducing the thatch layer (organic layer) to reinvigorate warm season grass growth while setting back cool season grasses. Later in the spring, prescribed burns in oak stands are implemented to reduce woody competition to favor oak seedling establishment and growth. The timing of these burns is typically when hardwood tree species are breaking buds which coincides with when prescribed fire will top kill these seedlings and give fire-adapted oak seedlings a competitive advantage when re-sprouting new shoots.

Results – Table 34 summarizes prescribed burn activity by objective for FY 2008 through FY 2013.

Table 34. Acres of prescribed burn activity by objective (FY 2008-2013)

Fiscal Year	Broadcast Burning (majority of unit)	Control of Understory Vegetation	Site Preparation for Natural Regeneration	Tree Release and Weed	Under Burn - Low Intensity (majority of unit)	Wildlife Habitat	Total
2008	0	0	0	0	30.2	0	**30.2**
2009	2	0	43	0	105	0	**150**
2010	78	0	0	0	0	0	**78**
2011	42	0	15	0	4	0	**61**
2012	0	0	0	228	0	157	**385**
2013	17.9	157	93	0	0	0	**267.9**
Total	**139.9**	**157**	**151**	**228**	**139.2**	**157**	**972.1**

Conclusions – Forest Plan objectives include using prescribed fire on 75 to 400 acres annually to enhance ecosystem resiliency, conserve fire-adapted plant and animal biodiversity, and maintain and restore mixed oak ecosystems (USDA-FS 2007a, p. 19). This objective has been met as an annual average of 162 acres was treated with prescribed fire to meet multiple resource objectives.

Through visual observations, warm season grass burns have limited favorable results due to the fire not consuming all of the thick thatch layers. Contributing to these results are the fuel arrangements and orientations from heavy snow pack.

Factors such as mowing, protection of fruit trees, and release tree cutting activities have made burning Buzzard Swamp Wildlife Management Area a challenge.

Recommendations – Fluctuations of annual prescribed burning acres are due mostly to weather conditions. Out-year prescribed fire planning will gear toward treating larger burn blocks to utilize good burning days and effective use of personnel.

For the Buzzard Swamp Wildlife Management Area, coordinate with wildlife staff and Pennsylvania Game Commission to mow fewer areas where there are plans for prescribed fire.

Utilize salvage sales to achieve multiple use objectives and recover timber value

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
In MAs 1.0, 2.1, and 3.0, utilize salvage sales to achieve multiple use objectives and recover timber value within two years of an event that kills or damages trees, such as insect infestation, disease, ice, wind, fire, or other catastrophic event.	How many acres in MA 1.0, 2.1, or 3.0 sustained damage from insects, disease, ice, wind, fire, or catastrophic event? How many acres were salvaged within 2 years of the event?	Annual	5 years	A/B

Protocol – Following a catastrophic event, areas of damage are delimited, mapped, and added to the ANF's GIS. Remote sensing technologies that map changes in forest canopies, such as the Forest Disturbance Change Assessment Tool (http://forwarn.forestthreats.org) can be used to help identify potential areas of change to assess through field visits. This type of technology is fairly new, with improvements to accuracy made based on feedback from users, including ANF staff. Areas of minor damage, such as scattered individual and small groups of trees are generally not recorded, while areas with more contiguous and extensive damage are evaluated, mapped, and prescribed for treatments if necessary. Timber salvage harvests sold and cut are compiled from vegetation databases, including the TIM and FACTS databases, and timber sale records.

In order to more efficiently and rapidly evaluate and salvage (as appropriate) the economic value of blown down or insect and disease caused tree mortality, ANF staff developed a Salvage Strategy in 2012. This strategy was used to guide evaluation and development of appropriate management responses to windstorm damage that occurred on the ANF in July 2012.

Results – Two events between FY 2008 and FY 2013 were significant enough to warrant mapping and a salvage response: the April 2010 Salmon Creek Fire and the July 2012 Windstorm. Table 35 summarizes the mapped acreage of damage, along with the ANF's response to each of these events.

Table 35. Catastrophic events and salvage plans (FY 2008-2013)

Unit	MA	Acres of Damage Mapped	Acres Salvaged as of September 2013	Acres Sold as of September 2013	Acres Planned to be Sold after September 2013	Acres Not Salvaged Due to Potential Resource Damage or Access Issues	Acres not Salvaged in Order to Meet Desired Vegetation Conditions
April 2010 Salmon Creek Fire							
629036	3.0	65[1]	0	0	40	25	0
July 2012 Windstorm							
Forest-wide	1.0	14	3	0	0	6	5
	2.2	46	0	0	7	0	39
	3.0	741	23	208	447	60	3
	Total	801	26	208	454	66	47
Grand Total		**866**	**26**	**208**	**494**	**91**	**47**

[1]Note: The full extent of trees damaged or killed by the Salmon Creek Fire were not immediately evident. Decline and mortality of these trees took longer to transpire, and the need to treat the area was identified early in 2012.

April 2010 Salmon Creek Wildfire

A wildfire occurred in the Salmon Creek area in April 2010. This was a surface fire that burned a total of 65 acres of oak forest. The damage from the fire took two growing seasons to really manifest itself, and in 2012 treatment needs were identified by Forest Service silviculturists. Due to the delay in visible changes in health of trees in this area, salvage of economic value from this wildfire did not occur within two years. Forty acres will be included for salvage harvest and restoration activities in the Salmon West project. The remaining 25 acres are not being proposed for salvage activity in order to address resource concerns such as protection of spring seeps and operability limitations such as large boulders.

July 2012 Windstorm

In total, 801 acres of moderate to severe windstorm-caused damage were mapped across the ANF as a result of the July 2012 Windstorm. Of the 801 acres, 234 acres (27%) in MAs 1.0 and 3.0 were cut or sold by September of 2013. Seventy-four acres were not considered suitable for salvage in MAs 1.0 and 3.0 because salvaging the area would cause unacceptable resource damage, the area is inaccessible, or the dead and down material contributes to desired vegetation conditions in these MAs. The remaining 447 acres of dead or damaged trees in MA 3.0 are considered suitable to salvage, and are scheduled to be sold by September 2014 – within or very close to two years of the 2012 windstorm.

Within MA 2.2, seven acres will be sold as salvage to address resource needs. The remaining 39 acres were not considered suitable for salvage as the dead and down material contributes toward desired vegetation conditions in MA 2.2.

Conclusions – Forest Plan objectives call for utilizing salvage sales in MAs 1.0, 2.1, and 3.0 to achieve multiple use objectives and recover timber value within two years of an event that kills or damages trees, such as an insect infestation, disease, ice, wind, fire, or other catastrophic event (USDA-FS 2007a, pp. 10 and 19). This occurs within the framework of achieving desired ecosystem conditions following

major wind events or other disturbances that leave large swaths of down or dead tree, where management responses occur to restore forest vegetation and remove salvageable timber.

Between FY 2008 and FY 2013, 866 acres of storm or fire damaged trees were identified and considered for salvage harvest to recover economic value of timber in MAs 1.0 and 3.0. The ANF has already or has plans to salvage timber on 79% of these damaged areas within two years of the catastrophic event. An additional 5% is scheduled to be sold within six years of the event where the damage took longer to manifest itself. The remaining 16% will not be salvaged due to potential resource or access concerns, or because the dead and down trees contribute toward desired vegetation objectives.

In MA 2.2, dead and damaged timber on 15% of the storm impacted area has been sold for salvage within two years of the event.

Recommendations – Continue monitoring overall forest health, including rapidly occurring catastrophic events such as wind and ice storms, along with slower moving disturbances, such as the decline and mortality caused by BBD. Future threats to forest health that may warrant recovery of economic value of timber include ash mortality caused by EAB, and hemlock mortality resulting from HWA.

Provide a minimum conifer component

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Provide a conifer component of greater than 15 ft^2 basal area per acre on a minimum of 10 percent of the ANF.	What percent of the ANF has a conifer component (> 15 ft^2 basal area per acre)?	Annual	5 years	A

Protocol – The basal area of conifer on the ANF was summarized using vegetation data in the FS Veg database. Coniferous species on the ANF include eastern hemlock, red pine, eastern white pine, scots pine, pitch pine, red spruce, white spruce, Norway spruce, black spruce, and tamarack (larch).

Results – Forest Plan desired conditions include sustaining eastern hemlock trees and other well-distributed conifer species to replace the ecological role that hemlock currently provides (USDA-FS 2007a, pp. 10 and 11). The ANF has 75,071 acres (approximately 15%) with > 15 ft^2 basal area/acre of conifer species.

Conclusions – Forest Plan objectives include providing a conifer component (greater than 15 ft^2 basal area/acre) on a minimum of 10% of the ANF (USDA-FS 2007a, p. 19). This objective has been met as there is presently a conifer component of greater than 15 ft^2 basal area/acre on 15% of the ANF.

Recommendations – Continue monitoring forest vegetation on the ANF to ensure adequate conifer cover is maintained.

Provide a minimum oak component

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Provide an oak component greater than 15 ft^2 total basal area per acre on 15 to 20 percent of the ANF.	What percent of the ANF has an oak component (> 15 ft^2 basal area per acre)?	Annual	5 years	A/B

Protocol – Percent oak cover on the ANF was summarized using vegetation data in the FS Veg database. Oak cover includes northern red, white, black, chestnut, and scarlet oak species.

Results – Forest Plan goals include providing a diversity of vegetation patterns with a variety of forest types necessary to achieve multiple resource objectives and sustain forest health (USDA-FS 2007a, p. 14). The ANF has 89,240 acres (approximately 18%) with > 15 ft^2 basal area/acre of oak species.

Conclusions – Forest Plan objectives include providing an oak component (greater than 15 ft^2 basal area/acre) on 15-20% of the ANF (USDA-FS 2007a, p. 19). This objective has been met as there is presently an oak component of greater than 15 ft^2 basal area/acre on18% of the ANF.

Recommendations – Continue monitoring forest vegetation on the ANF to ensure adequate oak cover is maintained. Where necessary, reintroduce fire and other disturbance necessary to ensure oak ecosystems are sustained in the future.

Provide minimum percent forest cover

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maintain 70 percent forest cover on the ANF.	What is the percent of forest cover on the ANF?	5 years	5 years	A

Protocol – Forest cover on the ANF was summarized using vegetation data in the FS Veg database as of April 2014.

Results – Forest Plan goals emphasize sustaining a diversity of vegetation patterns across the landscape. Forest cover occupies approximately 92% of the ANF.

Conclusions – Forest Plan objectives include maintaining 70% forest cover across the ANF (USDA-FS 2007a, p. 19). Current vegetation inventory data indicates this objective has been met during the first six years of Forest Plan implementation.

Recommendations – Continue monitoring forest vegetation on the ANF to ensure at least 70% forest cover is maintained.

Provide minimum percent grass and shrub openings

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage permanent grass and shrub openings on a minimum of 2 percent of the ANF, favoring native shrubs and herbaceous species.	What percent of the ANF is in permanent grass or shrub openings?	5 years	5 years	A

Protocol – Permanent grass and shrub openings on the ANF were summarized using vegetation data in the FS Veg database.

Results – Forest Plan goals emphasize sustaining a diversity of vegetation patterns across the landscape. Presently there are 14,142 acres of the ANF classified as non-forested habitat, including 2,494 acres of shrub habitat and 11,726 acres of open (primarily grass openings) habitat (Table 36). This represents 2.8% of the ANF.

Table 36. Acres and percent of shrub and open cover

Type of Cover	Acres	Percent of ANF[1]
Upland/lowland shrub	2,493	0.5%
Open (primarily grass openings)	11,649	2.3%
Total	**14,142**	**2.8%**

[1]Percent of ANF land area, excluding water

Conclusions – The Forest Plan has an objective to manage permanent grass and shrub openings on a minimum of 2% of the ANF, favoring native shrubs and herbaceous species (USDA-FS 2007a, p. 19). Current vegetation inventory data indicate this objective has been met during the first six years of Forest Plan implementation.

Recommendations – Continue to maintain existing herbaceous openings with the use of prescribed burning and top dressing. Consider the spatial distribution of herbaceous and shrub openings during the project planning process. Make recommendations during planning to enhance the benefits of openings or to create new openings where necessary.

Maintain moderate to well-stocked stands

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maintain moderate to well-stocked stands (relative density) on more than 90 percent of the forest lands on the ANF.	What percent of ANF forest lands contain moderate to well-stocked stands?	5 years	5 years	A

Protocol – Moderate (45-74% stocking) and well-stocked (> 75% stocking) stands on the ANF were summarized using vegetation data in the FS Veg database. The same stocking classes that were displayed in Table 3-21 of the Forest Plan FEIS were used to characterize vegetation (USDA-FS 2007b, p. 3-92).

Results – Forest Plan goals emphasize sustaining a diversity of vegetation patterns across the landscape, including moderate to well-stocked forest cover, in order to achieve multiple resource objectives and sustain forest health (USDA-FS 2007a, p. 14). Moderately to well-stocked stands comprise 91.4% of total forest lands on the ANF (Table 37).

Table 37. Acres and percent forest cover of moderately and well-stocked stands (all forest types)

Stocking	Acres	% Forest Cover
Well-stocked stands (>75% stocking)	288,809	59.0%
Moderately stocked stands (45-74% stocking)	173,765	35.5%
Total	**462,574**	**94.4%**

Conclusions – Forest Plan objectives include maintaining moderate to well-stocked stands (relative density) on more than 90% of forest lands on the ANF (USDA-FS 2007a, p. 19). Current vegetation inventory data indicate this objective has been met during the first six years of Forest Plan implementation.

Recommendations – Continue monitoring forest stocking levels on the ANF to ensure moderate to well-stocked stands are maintained in order to sustain forest health and multiple use objectives.

Watershed and Air

Complete soil and water restoration projects

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Complete soil and water restoration projects on 10 to 50 acres, annually	How many acres of soil and water restoration have been accomplished?	Annual	5 Years	A

Protocol – Soil and water restoration projects are completed by a variety of resource staff. Reported acres meet the WO definition of soil and water restoration:

> Includes treatments to protect, maintain, improve or restore water or soil resources. Treatments may be focused on soil productivity); quality and quantity of surface or ground water resources); or timing of water flows per FSM 2520. Land treatments, structures and other non-structural measures may be implemented. Land treatments may include those intended to protect, maintain, improve or restore a) soils and plant cover to prevent erosion, sedimentation and flooding); b) water infiltration, conservation or chemistry); c) water flows and geomorphic processes); or d) soil quality and productivity. Structural measures are those commonly used to

control water flow or supply, thus protecting, maintaining, improving or restoring soil stability, natural geomorphic processes, flood attenuation, runoff dispersion, infiltration or evaporative processes. Include non-structural measures, such as liming to reduce acidity, and restoration treatments when not required to mitigate another project.

Results – Annual soil and water restoration averaged 111.7 acres from FY 2008 through FY 2013 (Table 38).

Table 38. Acres of soil or water resources protected, maintained or improved to achieve desired watershed conditions (FY 2008-2013)

Fiscal Year	Soil and Water Restoration (Acres)
2008	139
2009	71
2010	108
2011	42.5
2012	184.5
2013	125
Total	670

Soil and water restoration include a variety of projects that maintain or improve watershed health. Example projects from the first six years of Forest Plan implementation include:

Morrison Run Watershed Restoration Project

Morrison Run is classified as an Exceptional Value stream by the PADEP and holds a good population of native brook trout. It is also a major tributary to Brown's Run and ultimately the Allegheny River, a federally designated Wild and Scenic River. Oil and gas producers, timber interests, and private land owners in the watershed have been willing and helpful partners in the Morrison Run Watershed Restoration project. The goal of the project is to restore and improve riparian and in-stream habitat throughout the drainage. Specific objectives include:

- expand the range and numbers of the native brook trout populations currently confined to isolated pockets throughout the drainage;
- eliminate all four fish passage barriers from the main stem;
- decommission or harden two fords on the main stem;
- reconstruct portions of FR 156 to improve drainage and reduce sedimentation; and
- improve and promote recreational opportunities (e.g., fishing) in the drainage.

Partners in the project include the Cornplanter Chapter of Trout Unlimited, Western Pennsylvania Conservancy (WPC), Warren County Conservation District (WCCD), Pennsylvania Fish and Boat Commission (PFBC), the ANF, and four private landowners.

In September 2013, WPC, the ANF, and PFBC completed a dam removal/stream restoration project 300' above the historic railroad tunnel. Fourteen root wads, four log vanes, three modified mud sills, and one cross vane were installed to stabilize stream banks and improve fish habitat in the former impoundment.

Corydon Cemetary Restoration

The Corydon Cemetary Restoration project was the result of several years of collaboration with the Seneca Nation of Indians, the Corydon Cemetery Association, the USACE, several federal and state congressional representatives, and other interested citizens. Completed in 2009, the project stablized the bank along the Corydon-Riverview Cemetery, the location of Chief Cornplanter. Erosion had resulted in sedimentation to the Allegheny Reservoir and the loss of graves and bodies of the Seneca Nation of Indians (Figure 44). The USACE provided hundreds of hours of staff time for collaborative meetings and to provide an engineering design for the project. The project was funded by the ANF and constructed by their construction and maintenance crew.

Figure 44. Eroded shoreline along Corydon-Riverview Cemetery before the rock berm wall was built (July 2007)

A rock bern wall was designed and constructed to dissipate the wave energy of the Allegheny Reservoir and provide stability at the base of the bank's steep slope (Figure 45). First, a trench was dug along the normal summer pool elevation level (~1328). An erosion fabric was then laid on the bottom of this trench and a rock berm was constructed which was keyed into the trench. Backfill was then placed in the area between the rock berm and the eroded shoreline. Thinnings of hardwood and white pine were completed to increase light levels on the shoreline and create a more vigorous understory less susceptible to erosion. The rock berm appears to be serving its purpose of absorbing the wave erosion during normal summer pool levels when compared to the erosion and undercutting that occurred prior to construction of the berm.

Figure 45. Shoreline along Corydon-Riverview Cemetery after the rock berm wall was built (August 2011). Vegetation was only 50% stabilized in the first 75' of the wall, but most of the berm has native willow recruitment stabilizing the soils. Sand has deposited behind the rock wall.

Big Mill Creek Alkalinity Passive Treatments

A review of PFBC records showed that Big Mill Creek had been steadily deteriorating as a result of long-term acidification by acid rain. Recent sampling by the Elk County Freshwater Association (ECFA) revealed chronic acidification (pH < 5) in its headwaters and in a majority of tributaries resulting in the loss of wild brook trout fisheries. Lower reaches of Big Mill Creek were periodically acidified (pH < 5.5) during high flows with the most severe conditions occurring in late winter and early spring.

In 2006, ECFA began working with a consultant and the ANF to restore Big Mill Creek through remediation involving alkalinity addition to the stream. Allegheny Watershed Improvement Needs (WINs) Coalition partners, ECFA, and the Elk County Conservation District monitored and implemented an alkalinity restoration project in this basin. The passive treatment approach they selected combines an aerobic limestone basin (AeLB) and anaerobic vertical flow wetland (AVFW). This system involves the diversion, treatment, and return of a portion of the stream flow at several headwater tributary locations.

ECFA completed four passive treatment systems on tributaries to Big Mill Creek from 2009 to 2011 on private and ANF land. Diverted and treated tributary stream flow contains elevated alkalinity sufficient to mitigate both chronic and episodic acidification in the tributaries. In combination, the four tributary

systems prevent episodic acidification in the lower mainstem as well as maintain baseflow pH > 6.5 and stormflow pH > 6. The combination of systems will restore water quality and aquatic life to at least 20 miles of Big Mill Creek and its tributaries. Based on the longevity of the treatment (25 to 50 years) the cost of the restoration will be less than $1,100 per mile per year.

The South Branch Kinzua Creek Alkalinity Passive Treatments

The South Branch Kinzua Creek alkalinity passive treatments project began in 2008 as a cooperative effort between the PFBC, Penn State Center for Dirt and Gravel Road Studies (CDGR), Penn State University, and the ANF. Alkalinity passive treatments were installed in the ditchlines along FR 279 to improve the alkalinity in headwater streams where low pH (ranging from 4.3 to 4.34) was likely a contributing factor to the low and/or lack of observed brook trout recruitment. CDGR designed the road segments and Dr. Rachel Brennan at Penn State University analyzed the acid neutralizing media (limestone sand and crab shell chitin) used within the passive treatment systems.

The results of initial monitoring have been promising. Improvements in water quality have been documented in each of the treated stream reaches. Alkalinity and pH levels rose sharply and then leveled off to adequate levels during the first year following treatment. Brook trout young of the year production has begun in two of three treatment reaches. Two native minnow species have recolonized one treatment reach. Brook trout redd surveys documented spawning effort in treatment reaches.

Conclusions – Forest Plan objectives include completing 10 to 50 acres of soil and water restoration projects annually (USDA-FS 2007a, p. 19). This objective has been met as an annual average of 111.7 acres of soil and water projects were completed. A significant amount of this restoration included improvement to road conditions which reduced sedimentation and runoff or allowed for passage of high flows to decrease downstream erosion. These activities included projects such as installing extra crossdrains to divert water to filter strips instead of directing it to streams and the application of DSA limestone.

There has been an increase in restoration projects due to collaboration with our partners in the Allegheny WINs Coalition. They have taken the lead on numerous projects, providing funding, labor, and contracting for multiple projects that have benefited the watersheds in the ANF. WINs Coalition volunteers and partners have also surveyed streams for problem areas and identified restoration sites.

Recommendations – A holistic approach should be used to address watershed concerns. Monitoring data should be used to determine what is causing pollution or lack of productivity in the watershed. A Watershed Restoration Action Plan should be completed so that all projects that are impacting water quality problems are addressed.

The Watershed Improvement Tracking (WIT) database should be utilized to track the location of the projects, funding information, and time period it was accomplished.

The ANF should continue to work with Allegheny WINs Coalition partners to complete important restoration projects on the ANF.

Additional monitoring of alkalinity treatment methods, like those implemented in the Bill Mill Creek and South Branch Kinzua Creek watersheds, is needed to determine their effectiveness. Based on favorable results, these methods should be applied in other watersheds impaired by acid deposition.

Follow-up is needed for the Corydon Cemetery Restoration project to determine if more thinnings are needed on the hillside.

Restore compositional/structural diversity of riparian areas

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Apply site-specific prescriptions to restore compositional and/or structural diversity of riparian corridors on 50 to 100 acres, annually.	How many riparian acres have been completed to improve vegetative diversity?	Annual	5 Years	A
	Have prescriptions improved riparian conditions for the benefit of riparian dependent resources?	Annual	5 Years	B

Protocol – Vegetation treatments within riparian corridors that are completed to restore compositional and/or structural diversity of riparian corridors are prescribed by wildlife biologists. These acres are reported as soil and water acres of improvement and acres of wildlife habitat improved. These acres should then be monitored to determine effectiveness.

Results – From FY 2008 through FY 2013, no site-specific prescriptions were implemented to restore compositional and/or structural diversity of riparian corridors. In the Upper Kinzua project, 27 acres of riparian corridors were approved for thinning within five stands.

Conclusions – Forest Plan objectives include applying site-specific prescriptions to restore compositional and/or structural diversity of riparian corridors on 50 to 100 acres annually (USDA-FS 2007a, p. 19). Although this objective has not been met during the first six years of Forest Plan implementation, it is important and should be implemented. With the workload of restoration projects, road work, and OGD, this type of project has not been a priority. Some of the proposals for improvements to riparian areas are in hemlock stands and implementation should consider the risk of attracting HWA to these stands.

Recommendations – Identify opportunities for vegetation treatments to improve riparian corridors in vegetation management projects. Conduct thinning treatments of hemlocks stands and monitor for HWA. More research is needed to determine if attraction of HWA to thinned hemlock stands truly is a risk, or if it is more beneficial to improve the health of overstocked hemlock stands. Track aspen regeneration treatments that occur in riparian areas.

Wildlife, Fish, and Sensitive Plant Habitat

Enhance terrestrial wildlife habitat

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Enhance terrestrial wildlife habitat to provide desired cover and forage conditions on 1,200 to 1,600 acres, annually.	How many and what type of terrestrial habitat enhancements have been implemented?	Annual	Annual	A

Protocol – Acres of terrestrial wildlife habitat restored or enhanced includes acres treated and structures installed (converted to acre-equivalents) to effectively: 1) provide a positive biological response from the target species or species group by maintaining or improving habitat used for foraging, breeding, or cover and security; and 2) restore ecosystem sustainability, resilience, or function.

Results

Table 39. Acres of terrestrial habitat restored or enhanced (FY 2008-2013)

Fiscal Year	Acres of Terrestrial Habitat Restored or Enhanced	Structures Installed
2008	1,195	122
2009	2,499	151
2010	20,643	194
2011	4,711	57
2012	10,402	20
2013	3,710	94
Total	**43,160**	**638**

Conclusions – Forest Plan objectives include enhancing terrestrial wildlife habitat to provide desired cover and forage conditions on 1,200 to 1,600 acres annually (USDA-FS 2007a, p. 20). This objective has been met as an average of 7,193 acres was enhanced annually from FY 2008 through FY 2013 (Table 39). Examples of terrestrial habitat enhancements included: wildlife opening construction, rehabilitation, and maintenance; planting of fruit trees, shrubs, mast trees, and conifers; establishment of warm season grass fields, vernal pools and wildlife meadows; building, installing, and maintaining nest boxes and bat boxes; and vegetation management activities benefiting wildlife habitat.

In FY 2010, integrated accomplishments were included in the accounting of acres of terrestrial habitat enhanced. Integrated accomplishments are activities completed by resource programs other than wildlife that also benefit wildlife habitat. Most vegetation management activities were initially accounted as an integrated accomplishment and terrestrial habitat restored or enhanced spiked in FY 2010. The interpretation of an integrated accomplishment in terms of vegetation management was later refined to only include activities that had a direct, intentional objective of habitat improvement, versus an incidental effect, leaving only final regeneration harvests completed in any forest type or MA, any vegetation management activity in late structural MAs (MA 2.2 – Late Structural Linkages or MA 6.1 – Late Structural Habitat), and any activity in oak forest types.

Recommendations – Continue to maintain existing herbaceous openings with the use of prescribed burning and top dressing. Consider the spatial distribution of herbaceous and shrub openings during the project planning process. Make recommendations during planning to enhance the benefits of openings or to create new openings where necessary. Inventory wildlife habitat and propose planting vegetation, installing nest boxes, or creating vernal pools where necessary.

Manage white-tailed deer populations

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage white-tailed deer populations at 10 to 20 deer per square mile to sustain herbaceous and woody species diversity across the landscape.	What is the deer density across the landscape?	Annual	5 years	B

Protocol – White-tailed deer (*Odocoileus virginianus*) density is estimated using the spring pellet group transect methodology (deCalesta 2013). There are 26 deer pellet transects completed annually on the KQDC (www.kqdc.com), a 74,000 acre collaborative project area, of which two-thirds includes the ANF, where private landowners and the ANF have implemented an adaptive management program with the goal of improving the quality of hunting and habitat. Outside of KQDC, transects are completed within project areas, areas of concern, as part of annual monitoring by NRS staff, or as part of research conducted by NRS staff.

Results – Deer density estimates from individual deer pellet transects ranged from 3.0 to 40.7 deer/mi^2 (Table 40). Average deer densities fluctuated annually on both the KQDC and outside the KQDC with KQDC density peaking at 17.2 deer/mi^2 in FY 2011 and density outside the KQDC peaking at 17.3 deer/mi^2 in FY 2013.

Table 40. Deer density (deer/mi^2) estimates from spring deer pellet transects on the ANF, both within KQDC (row 1) and outside of KQDC

	Fiscal Year					
	2008	**2009**	**2010**	**2011**	**2012**	**2013**
Deer Density – KQDC (deer/mi^2)	14.9	15.3	15.3	17.2	9.6	13.7
Transect						
Crane/Martin Project			8.7			
Hearts Content	11.2	6.1	7.8	28.3	11.4	
KEF West	6.7	3.0	13.2	11.0	5.0	
KEF East	15.2	4.5	10.2	13.0	5.7	
Tionesta West	3.1	13.4	7.0	6.9	7.1	
Tionesta East	11.6	21.3	14.7	6.2	5.0	
Bradford 40						13.8
First Hunt						14.6
Bloody Run 45						20.6
Bunts Run 21						10.1
Regen 06						12.0
Spring Creek 56						29.2
Transect 1	7.4					
Transect 2	12.1					
Transect 4	14.6					
Transect 10		5.3				
Transect 11	17.7		40.7	16.4	25.8	29.4
Transect 12	3.9	5.1	12.9	9.0	10.6	8.7
Transect 13			35.0			
Transect 14	27.8		13.8	14.1		
Transect 19	17.2					
Transect 20	14.6			8.2		
Transect 22			6.6	5.7		10.9
Transect 23			12.8			
Transect 27		7.4				
Transect 28		8.2				
Transect 29				8.9	5.2	10.8
Transect 30					12.4	27.6
Transect 31					9.3	
Transect 32			7.8		18.4	
Transect 33				21.4	22.1	
Transect 34					9.3	19.7
Deer Density – Outside KQDC (deer/mi^2)	**12.5**	**8.3**	**14.7**	**12.4**	**11.3**	**17.3**
DMAP Permits – KQDC*	300	550	800	800	800	905
DMAP Permits – Outside KDQC*	0	0	0	0	0	0

*DMAP permits offered preceding fall

Conclusions – Forest Plan objectives include managing deer populations to sustain herbaceous and woody species diversity across the landscape (10 to 20 deer/mi^2). This objective has been met as average deer density estimates across the ANF fell within this range from FY 2008 through FY 2013.

The range of deer density estimates illustrates the importance of continuing to use the PGC Deer Management Assistance Program (DMAP) as a management tool for targeting high deer densities. DMAP has been integral to the ANF's continued success in providing quality hunting; protecting its investment in healthy forest habitat and regeneration; and actively engaging the hunting community in the sustainable management of their public lands. During the first four years of the program, the ANF made judicious annual adjustments of DMAP permit requests and realized reductions in deer density and subsequent deer impact levels. These changes translated to a drastic reduction in the need for the ANF to fence and fertilize regeneration harvests and that decline has been sustained since FY 2007.

Recommendations – Building upon the two new DMAP Units implemented for the 2014-2015 hunting season, develop a long-term deer management strategy for the ANF to address the distribution of additional new DMAP Units across the Forest and annual deer pellet transect monitoring. Integrate other considerations affecting deer management where possible and as appropriate, e.g., deer behavior, hunter satisfaction, response of vegetation to browse, forage availability and its spatial distribution, hard and soft mast availability, severity of winter, harvest pressure, etc.

Complete fish habitat improvement projects

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Complete fish habitat improvement where habitat is lacking in reservoirs/ impoundments on 30 to 40 acres, annually.	How many acres of fish habitat improvements have been implemented?	Annual	5 years	A

Protocol – Fish habitat improvement projects are completed by a variety of resource staff and meet the Forest Service definition of *acres of lake ecosystem restored or enhanced*:

> This measure reports the surface acres of lakes, ponds, reservoirs and other aquatic lentic ecosystems restored or enhanced using structural or non-structural improvements in the reporting year using current-year funds. It is assumed that restoration/enhancement activities address environmental features limiting the biological capability of the particular water body and improve the condition of the aquatic ecosystem. Activities may include native aquatic species stocking or non-native invasive species removal. Include the portion of the water bodies that exhibit clear biological benefits as a result of the action taken.

Results – Acres of fish habitat improvements included projects, e.g., placement of structures and reservoir/lake cleanups, which restored and enhanced aquatic ecosystems in our reservoirs/impoundments (Table 41).

Table 41. Acres of fish habitat improvement/enhancement (FY 2008-2013)

Fiscal Year	Improvements/Enhancements	Structures	Acres
2008	Christmas trees	215	21.5
	Porcupine cribs	73	7.3
	Allegheny Reservoir cleanup	-	273
		288	**301.8**
2009	Christmas trees	171	17.1
	Porcupine cribs	24	2.4
	Allegheny Reservoir cleanup	-	273
		195	**292.5**
2010	Christmas trees	221	22.1
	Porcupine cribs, Jrs	54	5.4
	Allegheny Reservoir cleanup	-	273
		275	**300.5**
2011	Christmas trees	90	9
	Allegheny Reservoir cleanup	-	273
	Tionesta Lake cleanup	-	146
		90	**428**
2012	Christmas trees	64	6.4
	Porcupine crib, Jrs	54	5.4
	Allegheny Reservoir cleanup	-	273
	Tionesta Lake cleanup	-	146
		118	**430.8**
2013	Allegheny Reservoir cleanup	-	273
	Tionesta Lake cleanup	-	146
		0	**419**
Total			**1870.8**

Conclusions – Forest Plan objectives include improving 30 to 40 acres of fish habitat, annually (USDA-FS 2007a, p. 20). This target was exceeded tenfold every fiscal year from 2008 to 2013, and averaged 311.8 acres, annually. All of these projects came through collaboration with our partners in the Allegheny Watershed Improvement Needs (WINs) Coalition (annual reports are available at http://www.fs.usda.gov/main/allegheny/workingtogether/partnerships).

Recommendations – Continued collaboration with Allegheny WINs Coalition partners is critical to ensure Forest Plan objectives for improving fish habitat are met. A permanent Aquatic Ecologist position should be filled to manage the fisheries program, including coordination of fish habitat improvement projects with these partners.

In addition, a more formalized reservoir fisheries management plan should be developed to better plan, manage, and coordinate our efforts with those of our partner organizations. Such a management plan would ensure we are making decisions based upon best available science and mutually agreed upon long-term goals for the reservoirs' aquatic resources and the recreational opportunities they provide.

Complete stream restoration/enhancement projects

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Complete stream restoration or enhancement for native and desired non-native species where suitable aquatic habitat is lacking on 1 to 2 miles, annually.	How many miles of stream restoration or enhancement have been completed?	Annual	5 years	A

Protocol – Stream restoration or enhancement projects completed by a variety of resource staff and meet the Forest Service definition of *miles of stream ecosystem restored or enhanced*:

> This measure reports the miles of rivers and streams restored or enhanced using structural or non-structural improvements in the reporting year using current-year funds. Stream restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate aquatic ecosystem sustainability, resilience, and health under current and future conditions. Activities may include native aquatic species reintroduction or non-native invasive species removal.

Results – *Miles of stream ecosystem restored or enhanced* included a variety of projects that restore and enhance aquatic ecosystems in our streams and rivers using structural or non-structural improvements. From FY 2008 to FY 2013 projects included: road and stream crossing decommissioning, dam removals, installation of fish habitat improvement structures, riparian plantings, stream bank stabilizations, numerous aquatic organism passage projects, and the annual Allegheny River Cleanup, Conewango Creek Cleanup, and Brokenstraw Creek Cleanup (Table 42).

Table 42. Miles of stream ecosystem restored/enhanced (FY 2008-2013)

Fiscal Year	Projects	Stream Miles
2008	7	6
2009	7	38
2010	7	37
2011	9	52
2012	7	44
2013	19	44
Total	**56**	**221**

Conclusions – Forest Plan objectives call for the completion of one to two miles of stream restoration or enhancement for native and desired non-native species where suitable aquatic habitat is lacking, annually (USDA-FS 2007a, p. 20). This target was exceeded every fiscal year from 2009 to 2013, and

averaged 36.8 miles, annually. The annual Allegheny River Cleanup, Conewango Creek Cleanup, and Brokenstraw Creek Cleanup all started in FY 2009 and largely contributed to the success of this measure. A majority of these projects came through collaboration with our partners in the Allegheny WINs Coalition (annual reports are available at http://www.fs.usda.gov/main/allegheny/workingtogether/partnerships).

Recommendations – Continued collaboration with Allegheny WINs Coalition partners is critical to ensure Forest Plan objectives for improving fish habitat are met. A permanent Aquatic Ecologist position should be filled to manage the fisheries program, including coordination of stream restoration/enhancement projects with these partners.

In addition, a more formalized fisheries management plan should be developed to better plan, manage, and coordinate our efforts with those of our partner organizations. Such a management plan would ensure we are making decisions based upon best available science and mutually agreed upon long-term goals for the Forest's aquatic resources and the recreational opportunities they provide.

Manage active great blue heron colonies

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage active great blue heron colonies to ensure a stable or increasing population trend.	How many great blue heron colonies are known to be active? How many active nests are there? How many colonies have become abandoned?	Annual	5 years	A/B

Protocol – Known great blue heron (*Ardea herodias*) rookeries are observed in the field each year to record occupancy. Reports of new nests are field verified. Searches for new nests are occasionally conducted in high potential nesting habitat. Surveys are completed from a distance in order to minimize disturbance.

Results

Table 43. Great blue heron rookery occupancy and size (FY 2008-2013)

Fiscal Year	Results
2008	1 rookery with 8 nests active. 6 adult birds were observed.
2009	1 rookery with 1 nest, activity unknown, no birds observed.
2010	3 rookeries were monitored. One was inactive and nest was noted as gone. One had 1 nest and 1 adult was noted as incubating. One had 2 active nests and 3 adults observed.
2011	5 rookeries were monitored. Three no longer existed from the previous year. One had 15 nests, no activity was noted. One had 4 active nests with 2 adults and 4 chicks observed.
2012	6 rookeries were monitored. Three no longer existed from the previous year. One had 2 active nests with 4 adults and 1 chick observed. One had 2 nests, activity unknown, no birds observed. One had 29 nests with 9 active with 13+ adults and 4 chicks observed.
2013	5 rookeries were monitored. One no longer existed from the previous year. One had 3 active nests with 4 adults observed and 6-8 egg shells. One had 4 active nests with 1 adult observed and multiple young of year. One had possibly 3 active nests, no birds observed. One rookery had 29 nests with 5 active with 9 adults and 4 chicks observed.

Conclusions – Since FY 2008, at least five colonies have been abandoned or relocated. One colony of 29 nests fluctuates from year to year with activity (Table 43). Although habitat for the great blue heron is widespread, this species is very sensitive to disturbance and there are few known or historic rookeries on the ANF.

Recommendations – Continue to pursue reports of new nests and search for new rookeries in high potential nesting habitat. Continue annual monitoring of known rookeries and implement guidelines to protect known rookeries.

Manage occupied northern flying squirrel nesting sites

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage occupied northern flying squirrel nesting sites to ensure a stable or increasing population trend.	How many northern flying squirrel nest sites are known to exist? How many are occupied?	Annual	5 years	B

Protocol – Establish northern flying squirrel (*Glaucomys sabrinus*) nest box transects in suitable habitat and monitor nest box use annually.

Results – Seventy nest boxes were placed in suitable habitat for the northern flying squirrel and monitored. None of the 70 boxes have been occupied by northern flying squirrels. Two nest boxes had confirmed southern flying squirrels (*Glaucomys volans*).

There are two known nesting occurrences of the northern flying squirrel within the ANF proclamation boundary. One is on State Game Lands 29 and the other is within Chapman Dam State Park.

Conclusions – The northern flying squirrel is a Regional Forester Sensitive Species on the ANF. In Pennsylvania, it is listed by the state as an endangered species, it is listed as a priority species in the state's Wildlife Action Plan, and it is protected under the Game and Wildlife Code.

Northern flying squirrels prefer old-growth boreal forests that contain a heavy coniferous component, moist soils, and lots of downed woody debris. Pennsylvania's forests do not provide the old-growth conifer stands that are optimum habitat for northern flying squirrels and most remaining old-growth and appropriate hemlock/spruce habitat exists only in small, isolated fragments. As a result, Pennsylvania northern flying squirrels use forests that contain a mix of coniferous and deciduous trees that often are second-growth age class and associated with a water source.

Habitat factors influencing the northern flying squirrel's decline in Pennsylvania include loss of older conifer and mixed forest stands to development, especially in the Pocono Region, forest management practices geared towards wood products and early successional forest dwelling species, as well as the declining health of hemlock forest stands due to the HWA. Northern flying squirrels rely on specific fungi that are dependent on hemlock and spruce trees. Although smaller in size, the more numerous southern flying squirrel appears to be an aggressive competitor for tree cavities as well as food resources. It also carries a parasite that may be debilitating or lethal to the northern flying squirrel (www.portal.state.pa.us).

Recommendations – Continue to place nest boxes in suitable habitat and monitor annually. Consider a conifer replacement strategy in the event there is a loss of hemlock to HWA.

Manage known locations of plant species with viability concern

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage known locations of plant species with viability concerns to ensure a stable or increasing population trend.	How many locations of plant species with viability concerns are known on the ANF?	A	5 years	A/B

Protocol – The Natural Resource Information System (NRIS) – Threatened, Endangered, and Sensitive Plants (TESP) is the corporate database for inventory and mapping data for federally endangered or threatened and RFSS plants. The protocol for collecting data is contained in the USDA-FS 2008b.

Results – There are 140 known sites on the ANF with at least one plant species with viability concern.

Conclusions – Surveys conducted by ANF staff, contractors, and WPC Natural Heritage Program staff have successfully located plant species with viability concerns.

Recommendations – Continue surveys to refine data in and add data to NRIS-TESP. Develop another agreement with WPC to conduct additional surveys. Monitoring of known locations is needed to determine if sites are being impacted by non-native invasive species.

Manage suitable nesting habitat for yellow-bellied flycatcher

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage suitable nesting habitat for yellow-bellied flycatchers to ensure a stable or increasing population trend.	How much potential habitat of the yellow bellied flycatcher is occupied?	5 years	5 years	B

Protocol – Document yellow-bellied flycatcher (*Empidonax flaviventris*) occurrence during songbird survey drive routes and survey suitable nesting habitat using tape playback calls. Also, review the Second Atlas of Breeding Birds in Pennsylvania (Wilson et al. 2013). The Pennsylvania Breeding Bird Atlas provides species distribution maps that reflect the breeding bird behavior categorized by breeding evidence observed during surveys.

Annual songbird survey drive routes were chosen so that a variety of habitats were traversed. Routes were completed between dawn and 0930 with stops made every ½ mile. All singing birds were documented for five minutes. The number of routes completed varied from year to year.

Callback surveys were conducted during Pennsylvania Breeding Bird Safe Dates (June 10 – July 15) between dawn and 0930. Survey points were approximately 30 meters apart. Before playing the call, surveyors listened for two minutes at each point for spontaneously singing yellow-bellied flycatchers. After the initial listening period, the call was played for 30 seconds and the surveyor then listened for another two minutes.

Results – Suitable nesting habitat occurs across the Forest in the form of 9,249 acres of hemlock stands (1.9% of total forest cover) and 10,806 acres of other conifer stands excluding hemlock (2.2 % of total forest cover).

No yellow bellied flycatchers were documented during songbird survey routes or playback surveys. Two possible breeding occurrences were documented within the proclamation boundary in the Second Atlas of Breeding Birds in Pennsylvania (Figure 46). The confirmed breeding of yellow-bellied flycatchers state-wide declined by 19% between the first breeding bird atlas (1983-1989) and the second (2004-2009).

MAP BREEDING STATUS: ○ 1ST ATLAS ◉ 2ND ATLAS

Yellow-bellied Flycatcher (number of blocks)

Status	first Atlas 1983 - 1989	second Atlas 2004 - 2009	Change %
Possible	5	7	40
Probable	7	3	-57
Confirmed	4	3	-25
Total	16	13	-19

Figure 46. Pennsylvania-wide breeding status of yellow bellied flycatcher from the Second Atlas of Breeding Birds in Pennsylvania

Conclusions – In Pennsylvania, the yellow-bellied flycatcher is listed as state endangered and protected under the Game and Wildlife Code. Although not listed as endangered or threatened at the federal level, this bird is a USFWS Migratory Bird of Conservation Concern in the northeast.

Reasons for becoming endangered include extensive development and peat mining in the Pocono Mountains and elsewhere in northern Pennsylvania which has eliminated much of the habitat preferred by this species. Nesting pairs are found only in large forest blocks, suggesting that forest fragmentation also is a threat to this species. Small forest gaps are not avoided, however. Pests and diseases of native

conifers threaten the habitat of this and other conifer-related wildlife species. Also among the existing threats are changes in vegetation and reproductive capacity (www.portal.state.pa.us).

Recommendations – Continue to implement standards and guidelines to conserve suitable nesting habitat. Continue to survey potential habitat during songbird survey routes.

Manage active red-shouldered hawk territories

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Manage active red-shouldered hawk territories to ensure a stable or increasing population trend.	How many red-shouldered hawk active territories are known to exist?	Annual	5 years	B

Protocol – Known red-shouldered hawk (*Buteo lineatus)* nests are observed in the field each year to record occupancy. Reports of new nests are field verified. Searches for new nests are occasionally conducted before leaf out in high potential nesting habitat. Also, review the Second Atlas of Breeding Birds in Pennsylvania (Wilson et al. 2013). The Pennsylvania Breeding Bird Atlas provides species distribution maps that reflect the breeding bird behavior categorized by breeding evidence observed during surveys.

Results

Table 44. Red-shouldered hawk nests monitored and status (FY 2008-2013)

Fiscal Year	Territories Monitored	Active Territories (Female Incubating)
2008	3	3
2009	1	1
2010	5	5
2011	8	6
2012	10	6
2013	6	6

The possible, probable, and confirmed breeding behavior by red-shouldered hawks documented state-wide increased by 73%, 45%, and 13%, respectively between the first breeding bird atlas (1983-1989) and the second (2004-2009; Figure 47). This represented a 56% increase overall across the three status categories.

MAP BREEDING STATUS: ○ 1ST ATLAS ◉ 2ND ATLAS

Red-shouldered Hawk (number of blocks)

Status	first Atlas 1983 - 1989	second Atlas 2004 - 2009	Change %
Possible	440	760	73
Probable	175	253	45
Confirmed	136	154	13
Total	751	1167	55

Figure 47. Pennsylvania-wide breeding status of red-shouldered hawk from the Second Atlas of Breeding Birds in Pennsylvania

Conclusions – The Second Atlas of Breeding Birds in Pennsylvania indicated that the species deserves its vulnerable status; the population is distributed over a relatively broad area and may be declining in response to habitat alteration in some areas. Thirty-three nests were monitored between fiscal years 2008 and 2013 with the number of active nests increasing over that same period (Table 45). Although fledgling success is not tracked closely, at least nine of the active nests were observed to have produced at least one chick (nestling or fledgling). Monitoring results indicate the red-shouldered hawk population on the ANF is stable if not increasing.

Recommendations – Continue to monitor known nests and field verify reports of new nests.

Manage occupied osprey nesting sites

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Managed occupied osprey nesting sites to ensure a stable or increasing population trend.	What is the status of known nests? How many young are produced?	Annual	5 years	A/B

Protocol – Known osprey (*Pandion haliaetus*) nests are observed in the field each year to record occupancy and number of chicks fledged. Nests are checked often during mating season and less frequently when the chicks have hatched. Reports of new nests are field verified.

Results

Table 45. Osprey nest occupancy and fledgling success (FY 2008-2013)

	Fiscal Year Active (Y or N) Young Fledged					
Nest	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
1	N	Retired	Retired	Non-Extant		
2					N	N
3		Y 0	Y 3	Y 0	Y 0	Y 2
4		Y 0	Unknown	Unknown	Unknown	Retired
5			Y 1	Y 1	Y 0	Y 3
6			Y 3	Y 1	Y 3	Y 3
7		N	Unknown	Unknown	Retired	Retired
8			Y 2	Y 0	Unknown	Unknown
9				N	N	Retired
10					Y 1	Y 1
11				Y 0	Y 0	Y 2
Total Active Nests	**0**	**2**	**4**	**5**	**5**	**5**
Total Fledged	**0**	**0**	**9**	**2**	**4**	**11**

The possible, probable, and confirmed breeding behavior by osprey documented state-wide changed by 42%, -5%, and 900%, respectively between the first breeding bird atlas (1983-1989) and the second (2004-2009; Figure 48). This represented an 89% increase overall across the three status categories.

Osprey (number of blocks)

Status	first Atlas 1983 - 1989	second Atlas 2004 - 2009	Change %
Possible	111	158	42
Probable	22	21	-5
Confirmed	9	90	900
Total	142	269	89

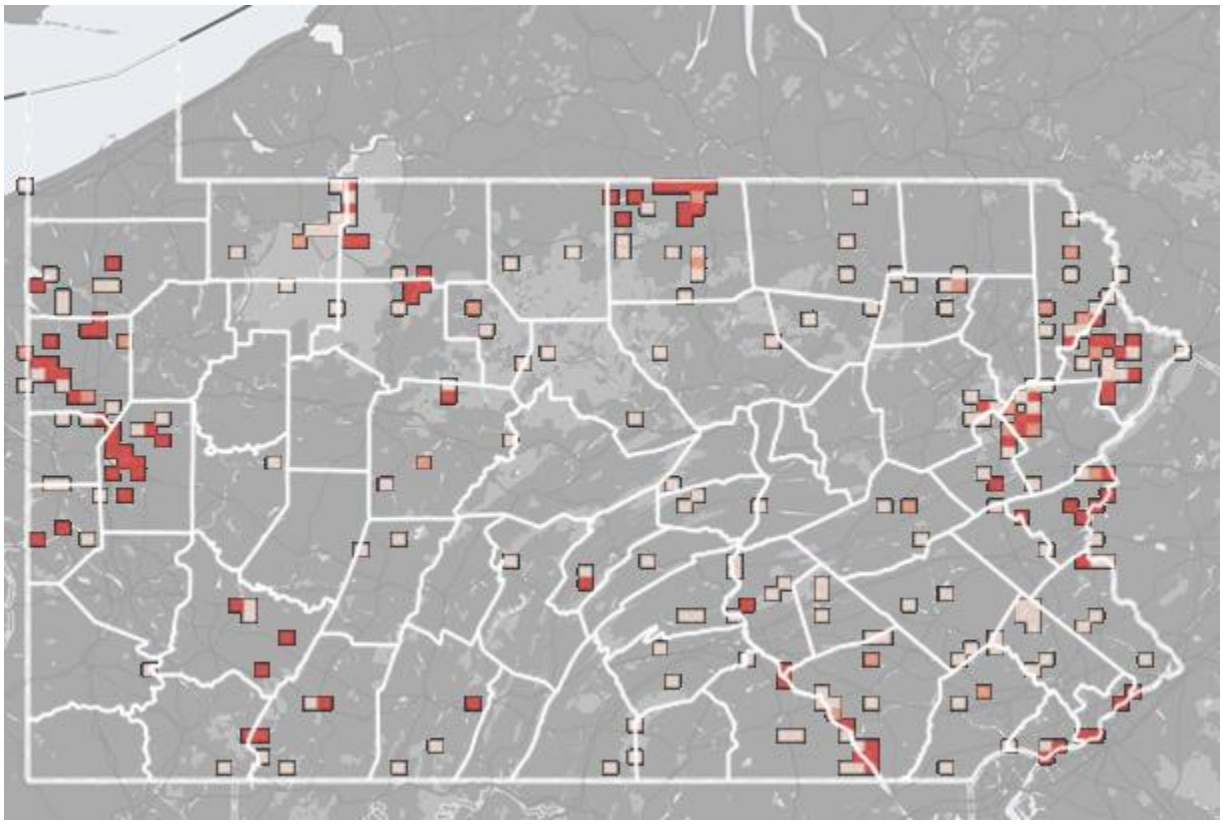

Figure 48. Pennsylvania-wide breeding status of osprey from the Second Atlas of Breeding Birds in Pennsylvania

Conclusions – In FY 2013, there were five active nests on the ANF. The well-established osprey pairs of nests 3, 5, 6, 10 and 11 usually successfully fledge at least one chick per year with nest 6 fledging three chicks for the past two consecutive years (Table 45).

In Pennsylvania, the osprey is listed as state threatened and protected under the Game and Wildlife Code. Nationally, they are not listed as an endangered or threatened species. Pennsylvania's nesting osprey population has been on the rise in recent years. During the Second Atlas of Breeding Birds in

Pennsylvania, confirmed nests were reported in at least 90 atlas blocks, and were widely distributed across the Commonwealth (www.portal.state.pa.us).

Recommendations – Place osprey poles in suitable areas, and create and retain natural snags where possible. Continue to monitor the activity of known osprey nests.

Prevent introduction of zebra mussels

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Prevent the introduction of zebra mussels into the Allegheny Reservoir and the Allegheny River from Forest Service boat launch sites.	Are zebra mussels in the Allegheny Reservoir? What is the risk of zebra mussel introduction from Forest Service boat launches?	Annual	Annual	B

Protocol – To assess whether zebra mussels (*Dreissena polymorpha*) are present in the Allegheny Reservoir, the shoreline on each side of Forest Service boat launches are walked a minimum ¼-mile to visually determine if they are present. This assessment is normally done after the reservoir drops to at least a pool elevation of 1,318' mean sea level (msl), or a drop of at least 10' from summer pool elevation of 1,328' msl in the fall. If a dock is present at the launch, it is also inspected for zebra mussels. The assessments are conducted by ANF employees.

As part of the conservation measures implemented for the clubshell and northern riffleshell (see also *Clubshell and northern riffleshell conservation measures*), to determine the risk for introduction of zebra mussels into the Allegheny Reservoir, a series of predetermined questions are asked boaters before they launch their watercraft. The objective is to screen (through personal interviews) at least 500 boats for the risk assessment. A sample of boaters is surveyed. Launch sites that typically receive the highest use are targeted first. The assessment is primarily conducted during the recreational boating season from Memorial Day to Labor Day. In addition to the questionnaire, boat trailers parked at launch sites are visually inspected for the presence of aquatic vegetation and/or zebra mussels. The objective is to visually inspect at least 1,000 trailers. The overall goal is to keep the risk low over the life of the Forest Plan. The boat screenings and trailer inspections were conducted by the concessionaires managing the Forest Service boat launches.

Results

Shoreline survey

Shoreline surveys were planned in FY 2008 to occur sometime in early-mid November, but a large snowfall occurred that prevented the survey from occurring. The FY 2009 surveys were conducted when the pool elevation was higher than 1318' msl (when surveys are normally completed) due to the potential for snow to cover the shoreline if delayed. In addition to the survey of shorelines, courtesy docks at Elijah, Kiasutha, Webbs Ferry, Willow Bay, and Wolf Run were inspected as follows:

- Elijah – shoreline survey conducted on each side of launch on 10-21-2009 at a pool elevation of 1320.4' msl. No evidence of zebra mussels was detected.

- Kiasutha – shoreline survey conducted on each side of launch on 10-21-2009 at a pool elevation of 1320.4' msl. No evidence of zebra mussels was detected.
- Roper Hollow – shoreline survey conducted on each side of launch on 10-20-2009 at a pool elevation of 1320.4' msl. No evidence of zebra mussels was detected.
- Webbs Ferry – shoreline survey conducted on each side of launch on 10-20-2009 at a pool elevation of 1320.4' msl. No evidence of zebra mussels was detected.
- Willow Bay – shoreline survey conducted on each side of launch on 10-21-2009 at a pool elevation of 1320.4' msl. No evidence of zebra mussels was detected.
- Wolf Run – shoreline survey conducted on right side (north) of launch on 10-21-2009 at a pool elevation of 1320.4' msl. No evidence of zebra mussels was detected.

A shoreline survey was not conducted in FY 2010. The period when the survey could have been conducted was short, after which a significant rain event increased the reservoir level dramatically. Snowfall and ice formation then occurred as the water level was receding, thus preventing a visual assessment.

In FY 2011, the shoreline adjacent to all seven developed boat launches on the ANF was surveyed for evidence of zebra mussels. These included:

- Dewdrop – shoreline survey conducted on each side of launch on 10-13-2011 at a pool elevation of 1313.8' msl. No evidence of zebra mussels was detected.
- Elijah – shoreline survey conducted on each side of launch on 9-29-2011 at a pool elevation of 1313.4' msl. No evidence of zebra mussels was detected.
- Kiasutha – shoreline survey conducted on each side of launch on 9-29-2011 at a pool elevation of 1313.4' msl. No evidence of zebra mussels was detected.
- Roper Hollow – shoreline survey conducted on each side of launch on 10-12-2011 at a pool elevation of 1313.8' msl. No evidence of zebra mussels was detected.
- Webbs Ferry – shoreline survey conducted on each side of launch on 10-12-2011 at a pool elevation of 1313.8' msl. No evidence of zebra mussels was detected.
- Willow Bay – shoreline survey conducted on each side of launch on 9-22-2011 at a pool elevation of 1314.7' msl. No evidence of zebra mussels was detected.
- Wolf Run Marina – shoreline survey conducted on each side of launch on 10-13-2011 at a pool elevation of 1313.8' msl. No evidence of zebra mussels was detected.

In addition to the survey of shorelines, courtesy docks at Elijah, Kiasutha, Webbs Ferry, Willow Bay, and Wolf Run were also inspected. No evidence of zebra mussels were found on the docks that were exposed at the time of the survey from the drawdown of the reservoir.

As a result of staff shortages, no shoreline surveys were conducted in FY 2012 or FY 2013.

Risk assessment

Watercraft screens – Of the 4,550 watercraft that were screened at four launch sites between FY 2008 and FY 2013 (Table 46), 80 were determined to be at medium risk for zebra mussel introduction into the reservoir, and 15 were at high risk. From FY 2009 through FY 2012 the screening results show a steady decrease in the total number of medium or high risk watercraft (MHRW) launched into the reservoir from 29 in FY 2009 to five in FY 2012.

The increase from five MHRW in FY 2012 to 11 in FY 2013 is entirely the result of an accounting adjustment and not an actual change in conditions on the ground. In previous years, the Allegheny River from Warren to Franklin, Pennsylvania, had been classified as free of zebra mussels. In FY 2013, it was reclassified for the purpose of the risk assessment to reflect the fact that in 2009 PFBC has found zebra mussels during a dam removal in the Conewango Creek in Warren, Pennsylvania, just upstream of the Allegheny River. There were no clusters of zebra mussels found on the exposed substrate, only scattered occurrences, and the occurrence is not reflected in the Pennsylvania Sea Grant and USGS Aquatic Invasive Species databases.

Of the 11 MHRW watercraft identified, eight had recently been in the Allegheny River and three had recently been in Chautauqua Lake. If this accounting adjustment had not been made and only the three Chautauqua Lake boats had been counted, the screening results would have reflected a continuing decrease in FY 2013.

Table 46. Watercraft at risk based on personal interviews with boaters (FY 2007*-2013)

Fiscal Year	Risk			
	Low	Medium	High	Unknown
2007 – 2008*	623	10	2	0
2009	967	22	7	3
2010	851	22	6	0
2011	808	10	0	7
2012	685	5	0	0
2013	508	11 (3)	0	3
Total	**4,442**	**80**	**15**	**13**

* FY 2007 and FY 2008 were combined since FY 2007 was a shortened season and only 96 watercraft were screened.

Boat trailer inspections – Of the 9,822 trailers inspected in the parking lots (Table 47), only one was found with vegetation and none had visible zebra mussels.

Table 47. Boat trailers inspected at Forest Service boat launches (FY 2008-2013)

Fiscal Year	Trailers Inspected	Trailers with Vegetation	Trailers with Visible Zebra Mussels
2008	1,139	0	0
2009	1,606	1	0
2010	1,390	0	0
2011	1,749	0	0
2012	1,897	0	0
2013	2,041	0	0
Total	**9,822**	**1**	**0**

Conclusions

Risk assessment

Watercraft screens – From FY 2000 through FY 2002, 11,114 watercraft were screened at launch sites with 1.3% determined to be MHRW for introducing zebra mussels (Table 48). In FY 2007-2008, MHRW increased to 1.9%, but was based on a much smaller number of watercraft screened. In FY 2009 and again in FY 2010, MHRW continued to increase to 2.9% and then 3.2%, respectively. These increases were primarily associated with boaters launching at Willow Bay as Kiasutha tends to be used more by local boaters.

Table 48. Summary of watercraft at risk based on personal interviews with boaters (FY 2000-2013)

Fiscal Year	Screened Watercraft	MHRW Watercraft	Percent of MHRW Watercraft
2000-2002	11,114	144	1.3%
2007-2008*	635	12	1.9%
2009	999	29	2.9%
2010	879	28	3.2%
2011	825	10	1.2%
2012	690	5	0.7%
2013	522	11 (3)	2.1% (0.6%)
Total (2007 – 2013)	**4,550**	**95 (87)**	**2.1% (1.9%)**

In FY 2011, the overall percentage of MHRW began to decrease dropping to 1.2% (with Willow Bay at 2.5% and Kiasutha at 0.7%). In FY 2012, MHRW dropped to 0.7% and in FY 2013 it dropped again to 2.1%.

The increase from five MHRW in FY 2012 to 11 in FY 2013 is entirely the result of an accounting adjustment and not an actual change in conditions on the ground. In previous years, the Allegheny River from Warren to Franklin, Pennsylvania, had been classified as free of zebra mussels. In FY 2013, it was reclassified for these purposes of the risk assessment to reflect the fact that in 2009 PFBC has found zebra mussels during a dam removal in the Conewango Creek just upstream of the Allegheny River. There were no clusters of zebra mussels found on the exposed substrate, only scattered occurrences, and the occurrence is not reflected in the

However, in FY 2013 an internal accounting adjustment was made and the Allegheny River from Warren to Franklin, Pennsylvania, was reclassified for the purpose of the risk assessment to reflect the fact zebra mussels have been found in the Conewango Creek in Warren, Pennsylvania, just upstream of the Allegheny River. As a result of this adjustment, the percentage of MHRW

rose to 2.1%. The overall average annual risk since implementation of the Forest Plan is also 2.1% (95 MHRW out of a total of 4,550 boats screened from FY 2007 through FY 2013).

Trailer inspections – From FY 2002 through FY 2004, 14,631 trailers were visually inspected with 0.9% (13) identified as having vegetation on them that could harbor zebra mussels. In FY 2007-2008, 0.4% (6) had vegetation marking a decrease from those earlier years. Only one of 1,606 trailers inspected in FY 2009 had vegetation on it (0.06%), and no vegetation was found in FY 2010 through FY 2013.

No visible zebra mussels have ever been found. Over the six years since implementation of the Forest Plan the total number of trailers with vegetation/zebra mussels was 8 out of 10,446 inspected (0.07%).

The number of watercraft screenings and trailer inspections has met the objective each season since implementation of the Forest Plan.

Through educational efforts conducted by Forest Service personnel, including personal contact and signs at launches as well as recreational boaters becoming more conscientious about aquatic invasive species, the introduction of zebra mussels has thus far not occurred to our knowledge from watercraft users launching at Forest Service sites on the reservoir. In addition, the drawdown of the reservoir each year would desiccate any zebra mussels that might get introduced and try to colonize in this portion of the reservoir.

Recommendations – Continue with watercraft screenings and trailer inspections at Forest Service boat launches to determine the risk of zebra mussel introduction. This includes many of the scheduled fishing tournaments that in previous years have not been screened, particularly at Elijah boat launch.

Renew annual inspections of docks and shorelines on each side of Forest Service boat launches to visually determine if zebra mussels are present. Also, begin annual SCUBA surveys of hardened surfaces and shoreline below winter pool levels to determine if zebra mussels are present.

Provide optimum and suitable vegetative habitat for Indiana bat

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Provide optimum and suitable vegetative habitat for Indiana bats on a minimum of 30 percent of the ANF.	How many acres of suitable and optimum Indiana bat habitat occur on the ANF?	5 years	5 years	B

Protocol – Much of the forested habitat on the ANF contributes in some way towards maternity landscape/roost habitat and foraging habitat for the Indiana bat (*Myotis sodalis*); however, some acres provide more beneficial habitat conditions than others. Suitable, optimal, and less than suitable roosting and foraging habitat are defined using the canopy closure criteria identified by Romme et al. (1995). Analysis of vegetation conditions (canopy closure) was summarized using vegetation data in the FS Veg database.

Results

Table 49. Acres of optimal, suitable, and less than suitable habitat for Indiana bat

Habitat Description	Habitat Quality	Present Condition (Acres/Percent of ANF)
Openings, seedling/sapling habitat, and canopy closure <20%	Less than suitable	33,496 acres 7%
Mid-late structural forests with canopy closures between 20% and 50% or >80%	Suitable roosting and foraging habitat	281,634 56%
Mid-late structural forests with canopy closures between 50% and 80%	Optimal roosting and foraging habitat	189,771 37%

Conclusions – Forest Plan objectives include providing optimal and suitable vegetative habitat for Indiana bat on a minimum of 30% of the ANF (USDA-FS 2007a, p. 20). This objective has been met as 37% of the ANF is currently optimal foraging and roosting habitat and an additional 56 % is suitable foraging and roosting habitat (Table 49). Because Indiana bat use is so minor on the ANF and suitable and optimal habitat conditions are dominant on the landscape, the amount of suitable habitat is not a limiting factor for the presence of this species.

Recommendations – Continue to use marking guidelines designed to retain an abundance of roost trees in a variety of size classes.

Maintain or increase productivity of bald eagles

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Maintain or increase productivity of bald eagles on the ANF.	What is the status of known bald eagle nests on the ANF? How many young are produced?	Annual	Annual	A/B

Background – On July 12, 1995, the USFWS reclassified the bald eagle (*Haliaeetus leucocephalus*) from endangered to threatened throughout the lower 48 states (Federal Register 1995). In March 1998, the USFWS announced plans to analyze information to determine if the bald eagle should be de-listed. In July 1999, the USFWS proposed de-listing the bald eagle.

The USFWS divided the lower 48 states into five recovery regions. Northwest Pennsylvania, including the ANF, is in the Northern States region. This region has a de-listing goal of 1,200 occupied breeding areas distributed over a minimum of 16 states, with an average annual productivity of at least 1.0 young per occupied nest. In 2006, there were 9,789 bald eagle breeding pairs over 48 states. Since then, the bald eagle was delisted in July 2007.

Protocol – Known nests are observed in the field each year to record occupancy and number of chicks fledged. Nests are checked often during mating season and less frequently when the chicks have

hatched. Reports of new nests are field verified. Searches for new nests are occasionally conducted before leaf out in high potential nesting habitat. Drive routes through suitable habitat are also conducted during the nesting season.

Results

Table 50. Bald eagle nest success for up to 24 known territories (FY 2008-2013)

Fiscal Year	Territories Monitored	Active Territories (Female Incubating)	Failed Territories	Young of Year	Young Per Active Nest
2008	10	5	0	8	1.6
2009	20	12	5	10	0.8
2010	19	12	3	13	1.1
2011	24	15	3	19	1.3
2012	20	10	1	19	1.9
2013	17	12	2	19	1.6

Conclusions – Annual productivity on the Forest from FY 2008 through FY 2013 has remained above the USFWS national recovery objective of 1.0 young per active nest every year except FY 2009 (Table 50). Average annual productivity since Forest Plan implementation began has been 1.4 young per active nest.

Recommendations – Continue to monitor nest success.

Minerals and Geology

Establish an oil and gas working group

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Establish a formal, multi-agency working group, including representatives from the ANF, PADEP, and other state and Federal agencies, to coordinate policies and processes regarding the management of oil and gas resources and infrastructure on the ANF.	Has a working group been established?	Annual	5 years	A

Protocol – ANF staff and other Forest Service representatives (e.g. NRS staff) evaluate opportunities to coordinate policies and processes regarding the management of OGM resources and infrastructure with various state regulatory and land management agencies (e.g., PADEP, PADCNR, PFBC, et al.) and federal agencies (USACE, U.S. Department of Energy, USGS, EPA, Bureau of Land Management, et al.). ANF also evaluates opportunities to participate in other stakeholder coordinated work/discussion groups (e.g., Pennsylvania State University – Center for Dirt and Gravel Roads, Pennsylvania Independent Oil and Gas Association, TNC, et al.). Based on the objective of the opportunity and

available resources, ANF and other Forest Service staff participate in work/discussion groups to further understand OGM development and its connection with land management considerations, including factors such as the continually changing regulatory environment; evolving BMPs; best available technologies; proposed, on-going, or completed research; and legal matters.

Results – A workgroup to specifically address management of oil and gas resources and infrastructure on the ANF has not been developed; however, the ANF has participated in numerous work/discussion groups related to OGM development from FY 2008-2013. A sample list of these coordination efforts are noted below.

- ANF and PADEP Workgroup (FY 2007-2008)
- PADEP/Pennsylvania Independent Oil and Gas Association Industry Workshops (FY 2007-2012)
- Pennsylvania State University Center for Dirt and Gravel Roads - Road Development from Pennsylvania's New Oil and Gas Rush Roundtable Meeting (FY 2008)
- Pennsylvania Center of Dirt and Gravel Roads Maintenance Workshops (FY 2008-2013)
- Pennsylvania State University Extension Webinars (FY 2008-2013)
- Pennsylvania and USGS Marcellus Shale Workshops (FY 2010, 2011)
- EPA Webinars (FY 2011)
- Susquehanna River Basin Commission Federal Agency Conference Calls (FY 2011-2012)
- Oil and gas research presentations on ANF (FY 2012)
- Federal Partners Marcellus Shale Comprehensive Plan (FY 2012-2013)
- Shallow Oil and Gas Developers' Roads Workgroup (FY 2013)

Conclusions – ANF and other Forest Service representatives have actively participated in numerous work/discussion groups related to OGM development from FY 2008 through FY 2013 involving various stakeholders.

Recommendations – ANF and other Forest Service representatives should continue to participate in work/discussion groups involving OGM development in order to advance learning and to stay current on pertinent topics, e.g., PADCNR Natural Gas Advisory Committee (NGAC). This will assist the ANF in adaptively managing its OGM program and other resource areas based on the most current and best available data – including, but not limited to scientific, regulatory, and legal considerations.

Establish and maintain an oil and gas development inventory

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Establish and maintain an inventory of all OGD on the ANF.	Has an inventory of all OGD been established and is it being maintained?	Annual	5 years	A

Protocol – The ANF establishes and maintains inventories of OGM development infrastructure using GIS technology. GIS layers have been initiated and updated using multiple sources with varying levels of accuracy – GPS technology, interpretation of aerial photography, interpretation of manually created maps, digitized state data, etc. The most reliable data sources typically are features identified and recorded using GPS technology or high resolution aerial photography. The main OGM GIS layers that have been maintained are wells and associated roads in the ANF's corporate road layer (i.e., TravelrouteLn), stone pit layers (both point and area features), and major pipeline infrastructure (i.e., utilities). These GIS layers have been maintained on the ANF for decades. During FY 2010-2011, the ANF used digital photography to digitize other oil and gas infrastructure throughout the ANF, such as tank batteries, compressor stations, buildings, structures, meter stations, and other OGM related equipment, as well as previously unidentified pipelines, roads, and wells. GIS information is typically updated on a project-level basis and undergoes a detailed quality control review before it is incorporated in the ANF's corporate GIS data. The quality control step is performed in order to maintain accuracy and completeness of the ANF's corporate GIS data.

Results

Non-system roads and wells

While the ANF was working on two Forest-wide projects concurrently in FY 2009 and FY 2010 – the SEIS and TEIS projects – thorough reviews of existing GIS layers associated with roads and oil and gas wells were completed. From these reviews, estimated non-system road mileages and existing wells (i.e., active or inactive wells) were made, and are illustrated in Table 51. Oil and gas roads are considered to be non-NFS roads, or non-system roads. For clarification, a portion of non-system roads may not be related to OGD (e.g., unauthorized trails/roads); however, this mileage makes up a small portion of the non-system road mileage total. During FY 2011-2013, unconventional well (i.e., Marcellus) development occurred on the ANF and is differentiated from shallow wells (i.e., conventional wells) in the GIS tabular data.

Table 51. Estimated miles of non-system roads and number of oil and gas wells (active or inactive)

	Estimates for Site-Specific Effects of Private Oil and Gas Development on ANF (USDA-FS 2010)	Estimate for Notices to Proceed (FY 2010-2013)	Comments	Estimated Totals
Non-System Roads (Miles)	1,695*	196 (1,956 wells x 0.1 mile per well)	Estimated 60 miles (600 wells x 0.1 mile per well) or more of non-system roads associated with wells which are being added to the corporate GIS data.	An estimated 2,000 miles of non-system roads on NFS land
# of Wells	9,764#	1,956 (including 19 Marcellus wells from 11 well pads)	Over 600 wells have been identified through aerial photograph during FY 2010 – 2013 which are being added to the corporate GIS data. Dozens of wells have been plugged.	Over 12,000 wells (active or inactive) on NFS land

*From Table 5 in USDA-FS 2010
#From Table 6 in USDA-FS 2010

Stone pits and pipelines

The ANF typically updates stone pit GIS layers when performing watershed-level project analyses. In addition, OGM-related pit development has been digitized for OGM-specific projects during FY 2012-2013 and is stored in project-level data. Most of the OGM-related pit development has not been incorporated into the ANF's corporate data. GIS spatial data sources associated with major distribution/transmission pipelines have not been updated during FY 2008-2013. This is because the vast majority of pipelines installed are gathering lines which serve a specific OGD. Gathering lines are typically digitized and documented in OGM project-level data and are not incorporated into ANF GIS corporate data.

Other OGM related infrastructure (tank batteries, compressor stations, structures, etc.)

During FY 2010-2011, the ANF used digital photography to digitize other oil and gas infrastructure throughout the ANF, and established a new infrastructure GIS feature class. This dataset contains information for tank batteries, compressor stations, buildings, structures, meter stations, and other OGM-related equipment. It is currently being updated.

Conclusions – The ANF has spent a considerable amount of resources during FY 2008-2013 to update existing OGM-related GIS layers (wells, non-system roads, stone pits) and to establish a new OGM infrastructure feature class, which includes data on tank batteries, compressor stations, building structures, meter stations, and other OGM-related equipment. Due to extensive private OGM development on the ANF, baseline OGM GIS data still have informational gaps which may be addressed using various existing data sources.

Recommendations – Continue to update and revise OGM-related GIS datasets using existing resources, including, but not limited to: GPS collected data, aerial photography, LIDAR data, state digitized data, data provided by OGM operators, and ANF digitized data. When informational gaps still are noted, develop strategies on how best to close these gaps using available resources. Implementation should be driven by priorities.

Identify resource concerns associated with oil and gas development

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Identify areas of resource concern associated with OGD. Collaborate with OGM operators to resolve concerns with long term mitigations and/or site restoration.	How many existing oil and gas developments have resource concerns? How many resource concerns associated with existing OGD have been resolved?	Annual	5 years	B

Protocol

Processing private (outstanding or reserved) OGM proposals

To reduce the likelihood of future resource concerns, the ANF collaborates with OGM operators, regulatory agencies, and other stakeholders during the planning, construction, and production phases of development.

Resource reviews – The ANF reviews new OGM development proposals for wildlife, water, soil, silvicultural, recreation, heritage and other resource concerns, both in the office and field. Resource concerns are reviewed in the office by resource specialists – the Resource Review Team – using best available data, including, but not limited to: GIS data, databases, previous survey data, practical knowledge, and other historical records, among others. The resource review team creates maps and summarizes in tabular format potential resource concerns and recommendations for road layouts, well locations, design features, mitigation measures, and additional field surveys. The maps illustrate operators' initial proposals, the Resource Review Team's recommended changes (i.e., road changes and well locations), and resource concerns.

Project layout, contracts and agreements – ANF OGM administrators use the information compiled by the resource review team to lead discussions, which may include ANF resource specialists or other ANF staff, with the operator during project layout and design. In addition,

regulatory agency representatives (e.g., PADEP) may be involved in field reviews and discussions throughout the process. Once final layout adjustments are negotiated, ANF staff work with the operator to process associated NFS timber and commercial road use permits or agreements for hauling on NFS roads, and to consider other mitigation measures. An operator is required to provide a minimum of 60 days advance notice of the commencement of development operations. The notice or development proposal is required to include the following Minard Run documentation:

- Identification of a Field Representative;
- Proof of Right to Exercise Mineral Rights;
- Map of the Proposed Development;
- Plan of Operations; and an
- Erosion and Sedimentation Control Plan.

In the event ANF staff believe a notice is incomplete, the operator is timely notified and asked to provide further information as appropriate. Following the conclusion of negotiations and completion of any applicable timber contracts and road use permits or agreements, an ANF line officer provides a Notice to Proceed with Operating Considerations to the operator. A Notice to Proceed is not a permit nor is its completion and delivery to operators a legal prerequisite to the commencement of operations. Rather, it describes agreed upon site-specific surface mitigation measures associated with the case, highlights selected Forest Service preferred BMPs, and may include reminders of an operator's responsibilities with various agencies' laws and regulations.

Inspections and Pre-work Coordination – Once a Notice to Proceed has been signed, a pre-work meeting is scheduled with the OGM operator, timber contractor, construction contractor, and Forest Service specialists as needed. The intent of the pre-work meeting is to foster valuable coordination to minimize potential conflicts with the operator's and ANF's operations. ANF staff inspect the preparation, drilling, operation, and plugging of OGM developments to identify unmitigated concerns. The ANF coordinates with the OGM operators and regulatory agencies (e.g., PADEP) to remedy identified concerns.

Protocol for responding to emergencies and addressing other resource concerns

The ANF coordinates response to oil and brine spills with OGM operators, the PADEP, and other pertinent regulatory agencies and stakeholders. The PADEP takes the lead in these response efforts; however, depending on the complexity of the incident, other agency representatives may be part of the incident command structure.

Similar coordination is used to resolve numerous other resource concerns (e.g., abandoned wells, roads, leaking wells); however, the lead agency may change based on the resource concern. In short, the ANF collaborates with various stakeholders to avoid and mitigate potential impacts or to resolve existing concerns on NFS land. Priorities are driven by the immediacy of the environmental or safety concern and the availability of resources.

Results and Conclusions – The ANF has processed 3,121 oil/gas well proposals, which includes the construction and/or installation of associated roads, well pads, pipelines, and/or tank batteries, as documented in Notices to Proceed from FY 2008-2013 (Figure 49). This number includes 19

unconventional wells (e.g., Marcellus) from 11 pads. In addition to these proposals, the ANF processed 19 pipeline and five seismic proposals during FY 2008-2013, as well as well plugging, compressor station, meter station, road access, etc., projects. The aforementioned private OGM review protocol has been used to process these proposals with the exception of six wells, which are USA mineral wells (Tract 13). Standard federal mineral processes were used to lease, plan and implement Tract 13, which included NEPA requirements. The ANF estimates over 12,000 active or inactive wells are located on NFS land with associated roads, well pads, pipelines, tank batteries, meter stations, structures, and other infrastructure.

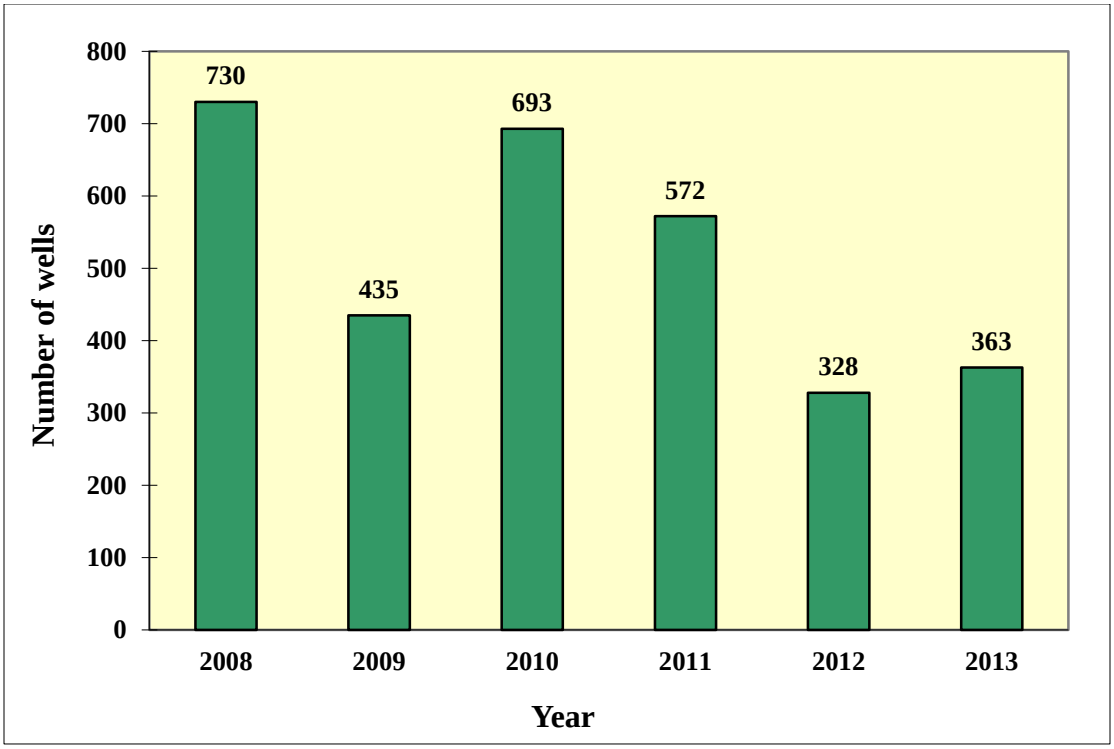

Figure 49. Number of wells processed as documented in Notices to Proceed (FY 2008-2013)

The ANF uses collaborative approaches to avoid, mitigate, or remedy resource concerns for processing OGM development proposals and administering existing developments – with proposals posing immediate environmental and safety concerns receiving the most attention. Based on sound planning principles and legal requirements, the ANF expends most of its available resources during the planning and implementation phases of OGM development to avoid or mitigate potential resource concerns. The mitigation, avoidance, or resolution of resource concerns are typically qualitatively documented in case-specific and project records, personal communications (e.g., inspection reports, communication records, e-mails), and similar assessment documents. Mitigation, avoidance, and resolution of resource concerns come with tradeoffs, which makes providing quantitative responses challenging and complex. Adjusting a road to avoid a stream crossing, for example, may impact a wildlife opening. In summary, the ANF works with OGM operators, regulatory agencies, and other stakeholders to resolve resource concerns and these resolutions are mostly documented qualitatively in case-specific or project records.

Recommendations – Continue to focus ANF resources on responding to emergencies and processing new OGM proposals with priority informed by environmental, safety, and legal considerations. Further

collaborate with operators, regulatory agencies, and other stakeholders to address long-standing concerns when available resources permit – prioritized by the immediacies and magnitudes of the existing environmental, safety, or other land management concerns.

Forest Pest Management

Treat acres to increase plant species diversity

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Improve the overall health and sustainability of ANF forest ecosystems by reducing understory dominance of native species, such as beech brush, ferns, grass and striped maple, and non-native invasive species (NNIS) to encourage greater species diversity of herbaceous, shrub, or tree seedlings on 3,000 to 6,200 acres annually (through direct treatment such as site preparation, herbicide application, scarification, and fencing).	How many acres have been treated to increase plant species diversity (with site preparation, herbicide application, and fencing)?	Annual	Annual	A

Protocol – Acres of site preparation (non-commercial felling of small trees so sunlight reaching the forest floor is increased and tree seedlings can become established), herbicide application, fencing and non-native invasive plant treatments that were implemented between FY 2008 and FY 2013 were compiled from the FACTS database.

Results – In total, 17,459 acres received site preparation, herbicide application, mechanical/herbicide treatment for NNIP, or were fenced between FY 2008 and FY 2013. These treatments occurred to reduce dominance by native and non-native interfering and invasive plants that prevent a diversity of herbaceous and tree species from becoming established, and to reduce deer browsing impacts. These treatments averaged 2,910 acres annually between FY 2008 and FY 2013.

Conclusions – Forest Plan objectives include reducing the understory dominance of native invasive species such as beech brush, ferns, grass, and striped maple, and NNIP by treating 3,000 to 6,200 acres annually (USDA-FS 2007a, p. 21). Overall, treatments implemented to improve overall health and sustainability of ANF ecosystems by reducing the abundance of native and non-native invasive species were just below the low end of average annual Forest Plan projections.

Annual herbicide application, site preparation and area fencing acres were below Forest Plan projections and objectives (see *Comparison of projected and actual outputs and services*). Herbicide application and site preparation levels were below that projected primarily due to fewer acres receiving shelterwood seed cuts and regeneration harvests (using either even-aged or uneven-aged methods) than projected in the Forest Plan. Deer browsing impacts have dropped in recent years because overall deer populations are reduced (see *Manage white-tailed deer populations*). As a result, the need to fence areas has declined markedly.

Herbicide and mechanical treatments to reduce NNIP populations have been increasing since FY 2008, particularly in FY 2012 and FY 2013. ANF staff specialists have been working to increase the local contractor pool to treat NNIP, and have been using newer authorities, such as stewardship contracting, to accomplish more NNIP treatment. Desired ecosystem conditions include restoration of understory vegetation and vertical diversity, including multiple vegetative layers to enhance the resiliency of forest ecosystems (USDA-FS 2007a, p. 11). Site preparation, herbicide application, and area fencing are some tools available to help reduce dominant understory vegetation that prevents a diversity of plants and tree seedlings from becoming established and contributing to compositional and structural diversity. An abundance and diversity of forest plants and trees will improve the overall health, resiliency, and sustainability of forest ecosystems on the ANF.

Recommendations – Continue monitoring progress toward achievement of desired understory vegetation conditions and the overall health and sustainability of forest ecosystems.

Fire

Develop a wildland fire use plan

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
A wildland fire use plan for managing naturally ignited fires within specific management areas will be developed, implemented, and incorporated into the ANF Fire Management Plan.	Has the ANF prepared a wildland fire use plan to manage naturally ignited fires?	Annual	When Completed	A

Protocol – There are no areas designated for managing naturally ignited fires on the ANF. Since the beginning of FY 2008, there have been 53 fires (an average of eight fires/year) that have been reported on the ANF. Almost all of these fires were classified as "human" caused starts.

Results – Due to the low frequency of naturally ignited fires on the ANF, no fire use plan to manage naturally ignited fires has not been developed.

Conclusions and Recommendations – Developing a wildland fire use plan to manage naturally ignited fires is not applicable to the ANF.

Use prescribed fire and mechanical treatments to reduce hazardous fuels

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
The ANF will apply prescribed fire and mechanical treatments for hazardous fuel reduction on 100 to 600 acres, annually.	How many acres of hazardous fuels reduction treatments have occurred?	Annual	5 years	A

Protocol – Primary hazardous fuel reduction results from activities such as prescribed burning, mechanical and manual treatment. Secondary hazardous fuel reduction results from activities that have a primary objective of emphasizing silvicultural or wildlife benefits, but a secondary benefit of hazardous fuel reduction, such as timber harvest, site preparation, release cutting, roadside brushing, and wildlife habitat prescribed burning.

Results

Table 52. Primary and secondary hazardous fuel reductions (FY 2008-2013)

Fiscal Year	Primary Fuel Reduction (Acres)	Secondary Fuel Reduction (Acres)	Total
2008	30.2	3,530.0	3,560.2
2009	105.0	4,598.0	4,703.0
2010	54.0	5,889.1	5,943.1
2011	61.0	6,530.0	6,591.0
2012	359.0	5,680.0	6,039.0
2013	267.9	154.0	421.9
Total	**881.1**	**38,842.4**	**39,723.5**

Conclusions and Recommendations – Forest Plan objectives include applying prescribed fire and mechanical treatments for hazardous fuel reduction on 100 to 600 acres annually (USDA-FS 2007a, p. 21). This objective has been met as hazardous fuel reduction treatments were applied to an average of 4,543 acres annually (Table 52). Prior to FY 2013, the ANF counted secondary fuel reductions in all forest types. In FY 2013, the ANF modified the definition of secondary fuel reductions and now only counts activities in fire-adapted forest types, e.g., oak, which explains the sharp reduction in acres in FY 2013. Continue to monitor treatments used to reduce hazardous fuels.

Land Ownership

Acquire subsurface ownership

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Work with partners to acquire subsurface ownership of lands in MAs 5.1, 5.2, 7.1, 8.1, 8.2, 8.3, 8.4, and 8.5 and withdraw these lands from future mineral development.	Have subsurface rights been acquired in these management areas? To what extent have these rights been withdrawn?	Annual	5 years	A

Protocol – The ANF works with partners when a potential opportunity arises to acquire subsurface ownership of lands in MAs where all Federal minerals (including oil and gas) shall not be available for leasing. These MAs are as follows:

- 5.1 (Designated Wilderness Areas)

- 5.2 (Wilderness Study Area)
- 7.1 (Developed Recreation Areas)
- 8.1 (Wild and Scenic River Corridor)
- 8.2 (National Recreation Area)
- 8.3 (Scenic Area)
- 8.4 (Historic Area)
- 8.5 (Research Natural Area)
- 8.6 (Kane Experimental Forest)

Results – The ANF has worked with partners who expressed interest in conveying mineral rights in a couple special areas. These partners, however, did not acquire the mineral rights from the subsurface owners, or the ANF was not able to accept these rights. These examples are noted below.

Rimrock Area

WPC contacted the ANF when oil and gas operators proposed wells and roads along Rimrock road and near the Rimrock Overlook, in FY 2007-2008. The Rimrock area is in MA 2.2 (Late Structural Linkages), however, it is a very popular recreation area on the ANF. The Western Pennsylvania Conservancy, therefore, was interested in discussing potential options of acquiring the subsurface rights in the area from the subsurface owner(s). The ANF and WPC discussed the value of the area, potential resource concerns, and various options. WPC contacted the subsurface owner(s) and was not able to acquire the mineral rights at the time.

Allegheny Front Region

The Northern Allegheny Conservation Association contacted ANF about donating the oil, gas, and minerals under 969 acres with in the National Recreation Area in Watson Township. Due to difficulties in obtaining title insurance and the inability to find an appraiser to determine the market value, this conveyance was not completed.

Conclusions – The ANF has worked with partners who expressed interest in conveying mineral rights in special MAs. These partners, however, were not able to convey the mineral rights from the subsurface owners in these instances for various reasons.

Recommendations – Continue to work with partners who approach the ANF to discuss options for acquiring mineral rights in MAs 5.1, 5.2, 7.1, 8.1, 8.2, 8.3, 8.4, and 8.5. In addition, talk with parties who may be interested in acquiring mineral rights in other areas of the ANF that may have similar site-specific management objectives as the aforementioned MAs.

Transportation System

Maintain roads

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Road maintenance activities to protect investments, minimize environmental effects, and provide public safety will occur on a minimum of 150 miles of passenger car roads (OML 3 to 5) and a minimum of 100 miles of high clear vehicle (OML 2) roads, annually.	How many miles of road maintenance have been accomplished?	Annual	5 years	A

Protocol – Road decommissioning includes activities that result in the ongoing upkeep of a road necessary to regain or restore the road to the approved road management objective (FSM 7710-Transporation Planning). Accomplishment of these activities was reported in the Roads Accomplishment Report (RAR) for FY 2008 through FY 2012 and in WorkPlan in FY 2013. Mileage is based on contract miles or as measured on the ground for work accomplished by user-generated funding.

Results

Table 53. Miles of road maintenance for passenger car roads (maintenance level 3-5) and high clearance vehicle roads (maintenance level 1-2; FY 2008-2013)

Fiscal Year	Maintenance Level 1-2 Maintenance	Maintenance Level 3-5 Maintenance
2008	62.1	395.1
2009	75.5	385.9
2010	149.9	353.6
2011	142.9	388.9
2012	121.2	395.7
2013	95.8	357.5
Total	**647.4**	**2,276.7**

Conclusions – Forest Plan objectives include completing road maintenance activities on a minimum of 150 miles of passenger car roads (OML 3 to 5) and a minimum of 100 miles of high clear vehicle (OML 2) roads, annually (USDA-FS 2007a, p. 21). This objective has been met as an average of 379.45 miles of OML 3-5 roads and 107.9 miles of OML 1-2 roads were maintained annually (Table 53). Maintenance on passenger car roads (maintenance level 3-5) remains fairly constant as these are the roads open to the public. There is greater variation in the maintenance of high clearance vehicle roads (maintenance level 1-2). Maintenance on these roads is dependent on specific resource needs (timber

sales, oil and gas activity, hunting, etc.). As resource activity increases, more maintenance level 1 and 2 roads require maintenance.

Recommendations – Continue to monitor road maintenance activities.

Decommission roads no longer needed

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Evaluate road benefits and risks and decommission 2 miles of roads that are no longer needed, annually.	How many miles of road have been decommissioned?	Annual	5 years	A

Protocol – Road decommissioning includes activities that result in the stabilization and restoration of unneeded roads to a more natural state. Accomplishment of these activities was reported in the RAR for FY 2008 through FY 2012 and in WorkPlan in FY 2013. Mileage is based on contract miles or as measured on the ground for work accomplished by user-generated funding.

Results

Table 54. Miles of decommissioned roads (FY 2008-2013)

Fiscal Year	Decommissioned Miles
2008	0.0
2009	0.0
2010	2.2
2011	2.6
2012	1.0
2013	0.0
Total	**5.8**

Conclusions – Forest Plan objectives include evaluating road benefits and risks and decommissioning 2 miles of roads that are no longer needed, annually (USDA-FS 2007a, p. 21). This objective was not met as an average of only one mile of road was decommissioned annually (Table 54). While project-level planning identifies roads for potential decommissioning, decommissioning often is not implemented as the roads are found to be needed for other resources, by adjacent landowners, or oil and gas operators.

Recommendations – When identifying roads for potential decommissioning during project-level planning, coordinate with other resources, adjacent landowners, and oil and gas operators to determine their need for the roads.

Surface roads with limestone

Forest Plan Objective	Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Surface an additional 5 miles of roads with limestone to minimize sediment delivery to streams, annually.	How many miles of road have been surfaced with limestone?	Annual	5 years	A

Protocol – Road surfacing activities are completed to minimize sediment delivery to streams. Accomplishment of these activities was reported in RAR for FY 2008 through FY 2012 and in WorkPlan in FY 2013. Mileage is based on contract miles or as measured on the ground for work accomplished by user-generated funding.

Results

Table 55. Miles of road surfacing (FY 2008-2013)

Fiscal Year	DSA Limestone Surfacing (Miles)	1" Minus (Miles)	PA 2A (Miles)	Paving (Miles)
2008	4.368	-	0.074	-
2009	16.300	-	0.038	11.300
2010	13.140	11.610	-	0.269
2011	8.837	3.802	-	-
2012	0.534	2.981	0.787	-
2013	2.975	0.406	0.628	-
Total	**46.154**	**18.799**	**1.527**	**11.569**

Conclusions – Forest Plan objectives include surface 5 miles of roads with limestone to minimize sediment delivery to streams, annually (USDA-FS 2007a, p. 21). This objective was met as an average of 7.7 miles of road were surfaced with limestone, annually (Table 55).

Due to ARRA funding the Forest received, surfacing activities increased in FY 2009 and FY 2010. Not only did the surfacing of roads with limestone spike, but also both Forest Service roads (leading to parking areas) and Township roads in need of repaving were paved (11.569 miles).

Since development of the Forest Plan, several different surfacing materials have been used on the ANF. 1” minus is a driving surface aggregate (DSA) sandstone surfacing designed for surfacing of dirt roads (18.799 miles paved between FY 2008 and FY 2013). It has the same gradation as DSA limestone, but is made with sandstone rather than limestone. It is available from local pits rather than needing to be trucked in from State College or Buffalo. It is not as hard as limestone. PA 2A is also available locally and designed as a subbase rather than a running surface (1.527 miles paved between FY 2008 and FY 2013). It has a coarser gradation than DSA and is used where riding comfort is not as important.

The Center for Dirt and Gravel Road Studies at Penn State University conducted a study to quantify sediment generation rates from unpaved roads on the ANF and determine differences in sediment production after new aggregate (either pit run or DSA) had been applied. Results showed that sediment production rates for DSA sites were approximately one-tenth that of the pit-run surfaces. The study concluded that, along with the potential for significant long-term environmental benefits, the long-range economic benefits should be considered when selecting road surface materials. In prioritizing the selection of different road surface materials, factors such as anticipated volume and type of traffic, and proximity to surface waters should be considered. The complete study can be found at: http://www.dirtandgravel.psu.edu/research/anf_study.html.

Recommendations – Continue to monitor road miles of surfacings.

Strategic Monitoring Information

Noxious Weeds

Effectiveness of non-native invasive plant controls

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
How effective have herbicide and manual NNIS controls been at eliminating targeted species?	Annual	5 years	A/B

Protocol – Monitoring treatment efficacy is an important and required part of a comprehensive invasive species management program. Monitoring treatment efficacy helps to validate treatment priorities, adapt future treatment techniques to meet project needs, determine the effect of treatments on non-target organisms, and generally complete project implementation. As defined in the protocol (USDA-FS 2014a), this monitoring is done the same year as treatment, and typically at the same time as treatment. This monitoring is different than what is typically considered long-term monitoring and the ANF has developed categories and local guidance (Table 56).

Table 56. Categories and ANF guidance for effectiveness monitoring

Code	Percent Efficacy	Rating	Description	ANF Guidance
0	0%	No effect	No effect can be detected on the target species population.	
03	1%-5%	Failure	Little to no effect can be detected on the target species population.	
15	6%-25%	Poor	Treatment killed less than a quarter of the target species population.	
35	26%-50%	Marginal	Less than half of the target species population was controlled	
65	51%-75%	Fair	Over half of the target species population was controlled.	
85	76%-90%	Good	Treatment was successful in killing most of the target species population	
95	91%-99%	Excellent	Over 90% of the target species population has been killed with the treatment.	Mastication with habitat machine. Used for mowing.
100	100%	Complete	Not a single individual of the target species population was found after a complete survey of the site. Infestation was eradicated on the site.	Used for hand pulling, herbicide treatment e.g., hand pulling of garlic mustard where able to pull all plants or herbicide treatment.

Results – A total of 622.2 acres of NNIP was treated across the ANF from FY 2008 through FY 2013 (*Treat invasive plants*).

Manual and mechanical treatment has proven effective in controlling annuals (e.g., mowing of yellow rocket, *Barbarea vulgaris*) and biennial species (garlic mustard, *Alliaria petiolata*) in which treatments

are targeted before seed set to reduce seed production and lessen seed banking. Manual and mechanical treatments were also used where herbicide use is prohibited (riparian buffer areas). This type of treatment is also used to reduce the standing biomass of plants so that subsequent herbicide treatment is more effective by being able to thoroughly cover vegetation and the amount of herbicide used is greatly reduced. For example, the Japanese knotweed infestation at the north end of FR 268 was masticated with a FECON mulching head in July of 2013 (height of plants 15-20 feet) and the resprouts (2-3 feet) were treated with a 2% solution of Accord XRT in September of 2013. Growth in 2014 has been greatly reduced to only a few stems, and will be retreated in 2014. Japanese knotweed is one of the species that has large rhizome root reserves and retreatment is expected to occur for at least three years to kill it. Year-after treatment monitoring of select stewardship service work sites within Coalbed ReAdd (Bradford Ranger District) and Clarion Highlands FR 237 (Marienville Ranger District) show mortality of target species such as multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thungbergii*), and Morrow's honeysuckle (*Lonicera morrowii*).

Conclusions – A combination of manual/mechanical treatments and herbicide use has been effective in eliminating targeted species in treatment areas. An integrated approach is used to conduct treatments with the least harm to the environment and human health, and applies the most economical use of the resources at hand.

Recommendations – While effectiveness monitoring is required for target accomplishment credit, it is also important to continue monitoring select locations for year-after treatment effectiveness in terms of resprouts, seed banks, or missed plants. Flexibility is key to being able to effectively treat target NNIP species. While the ANF has been able to procure most of the necessary tools, there still is a need for at least one seasonal NNIP technician whose sole responsibility is NNIP treatment, as well as a mastication head and tracked piece of equipment. While some of this type of mastication work can be contracted, short time frames due to weather and growing conditions make it necessary to have this equipment available on short notice. Renting equipment has been useful; however, if we get only one week between two feet of snow cover followed by warm temperatures which causes the ground to thaw prior to bird nesting season, as was the case for work at Hopkins Farm in the spring of 2014, it is critical to have that equipment in-house.

Recreation

Resource damage from equestrian use outside equestrian use areas

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Is resource damage from equestrian use occurring outside of EUAs?	Annual	3 years	B

Protocol – Recreation personnel conduct a visual inspection of the areas known to be frequently used outside of Equestrian Use Areas (EUAs).

Results – Resource damage continues to be localized and limited to user-defined trails.

Conclusions and Recommendations – Eliminate open (cross-country) riding where unacceptable cultural or natural resource damage occurs, and evaluate whether an area should be designated as an

EUA. In addition, encourage riding on the 38-mile Spring Creek horse trail with proper signing and working with local riding clubs and user groups.

Vegetation

Structural and compositional vegetative characteristics within stands and at the landscape scale

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
For even-aged management and uneven-aged management, characterize stocking, species composition, seedling establishment time, treatment cost, effectiveness of reforestation treatments to obtain species diversity and sustain forest type, particularly with regard to the various opening sizes under uneven-aged management. What are the structural and compositional vegetative characteristics within stands and at the landscape scale? What refinements need to be made to silvicultural practices?	Annual	5 years	A/B

Protocol – Use vegetation accomplishment data from FACTS to identify even-aged management and uneven-aged management harvests completed, along with inventory data (common stand exam) from the FS Veg database to assess stand and seedling composition. Also utilize results from local research studies on uneven-aged management techniques conducted by NRS.

The 2007 Forest Plan provides for increased opening sizes when implementing uneven-aged management with group selection regeneration methods. During the 1986 Forest Plan period, uncertainty and poor success resulted with establishing tree seedling regeneration when using uneven-aged management. Additionally, substantial concerns exist about the use of uneven-aged management that features strictly shade-tolerant tree species, such as American beech, sugar maple and eastern hemlock, all of which face serious forest health threats. Consequently, new design criteria were incorporated into the 2007 Forest Plan for the use of uneven-aged management, to reduce the uncertainty and potential for forest health concerns associated with shade-tolerant species, while increasing its long term successfulness in establishing a diversity of tree seedlings. These guidelines include allowing for larger opening sizes, with the intent of establishing a greater diversity of tree species with greater shade-tolerance ranges, including shade-intolerant species (e.g. black cherry, yellow poplar, northern red oak) and mid-tolerant species (e.g. red maple, birch, cucumber), than would occur under 1986 Forest Plan design criteria for uneven-aged management (USDA-FS 2007a, p. A-2).

This monitoring question focuses on uneven-aged management outcomes using new design criteria in the 2007 Forest Plan. To evaluate the successfulness of uneven-aged management using these new design criteria, the bulk of this monitoring discussion focuses on uneven-aged regeneration harvests.

Results

Even-aged regeneration

Even-aged management is the predominant regeneration method applied on the ANF. As noted in the Stocking within Five Years of Final section of this document, scheduled green even-aged (single-aged) final harvests had the greatest success rates with a weighted average regeneration success rate is 93.5% between FY 2003 and FY 2008. The weighted average is 98.5% when regenerated areas that are nearly fully restocked and considered probable successes are included. Areas regenerated with even-aged methods are dominated by shade-intolerant and intermediate species such as tulip poplar, black cherry, red maple, birch species, and aspen in some cases.

Between 2008 and 2013, 2,711 acres had even-aged regeneration harvests completed. These young stands nearly always dominated by a mix of black cherry, black birch, and red maple. In some cases, tulip poplar, aspen, or in rare cases, oaks dominate these stands. Other mid-tolerant and shade-tolerant species such as cucumber, sugar maple, and eastern hemlock frequently occur, while shade-tolerant American beech and striped maple nearly always occur in areas regenerated using even-aged regeneration methods. In recent years, the abundance and overall dominance by black cherry has been declining in even-aged regeneration harvests, while black birch and red maple have been increasing in abundance and importance.

Uneven-aged regeneration

Between FY 2008 and FY 2013, 47 stands (744 acres) had uneven-aged harvests completed (Table 57). Many of these were implemented in response to natural disturbances, such as the 2003 windstorm, insect and disease caused mortality, or other similar event. Treatments in these cases were not planned with natural disturbance impacting seed tree abundance and distribution, stand structure, and overall stocking, thus limiting future management opportunities. As these uneven-aged harvests were implemented in response to a natural disturbance, they were not included in this evaluation of overall effectiveness of uneven-aged management, particularly with regard to group opening size. Other uneven-aged treatments are part of a formal study on the Kane Experimental Forest being conducted by NRS. The treatments in this study have not been fully implemented, but are reflected in Table 57 and an interim summary of findings to date is summarized below.

Table 57. Number of stands (acres in parenthesis) with uneven-aged harvests (FY 2008-2013)

Treatment	Research Study	No reforestation completed	Too Small to Evaluate	Windthrow	Salvage	Scheduled-Green	Grand Total
Single Tree Selection	8 (39)	1 (55)	-	-	9 (245)	17 (296)	35 (635)
Group Selection	4 (20)	-	1 (3)	5 (41)	1 (11)	1 (34)	12 (109)
Total	**12 (59)**	**1 (55)**	**1 (3)**	**5 (41)**	**10 (256)**	**18 (330)**	**47 (744)**

Eighteen stands where single tree or group selection was implemented have current seedling stocking survey data and were evaluated for this monitoring item. These include windthrow, salvage and

scheduled-green single-tree selection harvests, and windthrow and scheduled-green group selection harvests.

Single tree selection

Stocking – Of the16 stands with single tree selection harvests completed where seedling stocking survey data was available, nine stands did not have sufficient seedling stocking to meet ANF handbook direction for restocking areas managed with uneven-aged regeneration methods. Nine of these stands contained less than 10,000 seedlings to the acre (compared to 30,000+ seedlings per acre that might be expected in similar even-aged regeneration harvests). The remaining seven of these stands had more than 30% of sampled plots stocked with tree seedlings (see species composition discussion below), meeting minimum restocking requirements per ANF handbook direction.

Species composition – Ten of the 16 stands evaluated with single tree selection harvests completed are dominated by shade-tolerant American beech, and five stands are dominated by shade-intermediate birch. Nearly every stand that received a single tree selection harvest was dominated by species with forest health concerns (e.g., American beech) or shorter lived species (birch species, which often die due to mechanical failure by age 60, Forest Plan EIS p. 3-129). Most of these stands did contain smaller seedlings of shade-intolerant and mid-tolerant species, predominantly shade-intermediate red maple with lesser amounts of black cherry seedlings. However, without additional sunlight provided to those tree seedlings less tolerant of shade, including investments in low shade removal and release activities, the majority of these shade-intermediate and intolerant seedlings will not persist.

The remaining stand received a site preparation treatment to remove low shade and contains a mix of black cherry, sugar maple and red maple seedlings meeting desired seedling stocking and composition objectives.

Many of the single tree selection treatments reflected in Table 58 will be followed up with group selection once desired tree seedlings are established in order to provide additional sunlight for a range of shade-tolerant tree seedlings.

Seedling establishment time – As only one of the single-tree selection harvests evaluated contains desirable tree seedlings comprised of species similar to overstory composition, this portion of this monitoring item cannot be effectively or accurately evaluated at this time.

Treatment costs and effectiveness of reforestation treatments – Fifteen of the 16 single-tree selection harvests evaluated did not have reforestation treatments implemented and were implemented in response to tree decline and mortality; therefore, this portion of the monitoring item cannot be effectively or accurately evaluated until more scheduled (planned) uneven-aged treatments are implemented.

As noted above, single tree selection harvests on the ANF are typically the first step in a sequence to regenerate an area using uneven-aged methods. Single tree selection harvests would be followed up with group selection harvests once desired tree seedlings are established.

Kane Experimental Forest research study

A research study on the Kane Experimental Forest contrasts stand development under five different silvicultural systems, including single-tree and group selection (1986 Forest Plan design criteria, with openings less than 0.5 acres) treatments. The first treatments were applied in 1980 and for the first two decades stands developed outside fences. The treatments were applied to mature stands that were approximately two-aged. Prior to the treatments, 77.5% of regeneration sample plots across all treatments were dominated by American beech seedlings or saplings. Five years after treatment, domination by American beech was reduced to 62 (+/-10)% in group selection treatments, and to 56 (+/-7)% in single tree selection treatments. By ten years after treatment, in 1990, these numbers had grown to 66 (+/-9)% in group selection treatments and 62 (+/-9)% in single tree selection treatments.

Seedling development of species other than beech, birch, and striped maple was slow with only 3.8 (+/-1.3)% of the plots in the group selection treatments and 2.5 (+/- 2.5)% of the plots in the single-tree selection plots adequately stocked with other species more than five feet tall. When these results were analyzed using measures of species diversity the results depended on the measure of species abundance used. Forest management appeared to increase species diversity across treatments when measured in stem counts, while diversity appeared to decrease when measured in biomass. This anomaly is due to the rapid growth of beech, which decreased in stem numbers as it increased in biomass.

As a result of these patterns, a decision was made to implement the group selection treatment as a shelterwood treatment when the plots were retreated in 2007. The understory of the group selection plots was non-commercially removed, to allow for the development of more diverse seedlings without the interference of low shade. Specifically, in 2013, the average sapling basal area in single-tree selection treatments was 16 (+/-3.9) square feet per acre, while in group selection treatments sapling basal area had been reduced to 1 (+/-1.9) square feet per acre.

It is too early to assess the results of these treatments, but we can summarize some regeneration variables as measured in 2012. Both single-tree and group selection treatments had seven species in the regeneration (considering all size classes, including seedlings of the year). Both had fewer than 5% of their regeneration sample plots stocked with regeneration other than beech, birch, and striped maple more than five feet tall. In single-tree selection plots, 59 (+/-20)% of the plots were dominated by American beech, while in group selection plots 47 (+/-21)% of the plots were dominated by American beech (not a significant difference). The minor differences between single-tree selection and group selection composition can be attributed to the small group opening sizes utilized (less than ¼ acre, consistent with 1986 Forest Plan design criteria).

The interim results of this research study are similar to seedling stocking and composition outcomes observed in single tree selection or pre-2007 group selection harvests (implemented using 1986 Forest Plan design criteria with openings sizes less than ¼ acre) completed on the ANF.

Group Selection

> Stocking – Two stands have had group selection harvests completed, both of which had adequate tree seedling stocking within three years of group selection harvest. Both of these stands had more than70% of sampled plots in the group openings stocked with tree seedlings (see species composition discussion below), meeting minimum restocking requirements per ANF handbook direction.

Species composition – One stand had group selection implemented in response to the 2003 windstorm and had been fenced with site preparation implemented prior to group selection harvest. This stand has variably sized group selection openings that range from ¼ to 1.8 acres established to address catastrophic windstorm damage. The groups are dominated by birch with some red maple in the smaller size classes.

The other stand was a planned group selection (as opposed to a response to catastrophic natural disturbance) that implemented using 2007 Forest Plan design criteria, with group selection openings ranging from 2.5 to 3 acres in size. Species composition in the group openings was clearly different from that observed in single tree selection harvests that were implemented during this time frame and where smaller group openings were used. In the larger group openings, seedling stocking was diverse with a mix of shade-intolerant (tulip poplar, black cherry, northern red oak), mid-tolerant (red maple and birch), and shade-tolerant (American beech) tree seedlings.

Seedling establishment time – As only two group selection harvests have been implemented and only one using 2007 Forest Plan design criteria, this portion of this monitoring item cannot be effectively or accurately evaluated at this time.

Treatment costs and effectiveness of reforestation treatments – As only two group selection harvests have been implemented and only one using 2007 Forest Plan design criteria, this portion of this monitoring item cannot be effectively or accurately evaluated at this time.

Conclusions – Forest Plan desired conditions include providing a diversity of vegetation patterns across the landscape that represents well distributed habitats, a range of forest age classes and vegetative stages, a verity of healthy functioning vegetation layers, and a variety of vegetation species or forest types necessary to achieve multiple resource objectives and sustain forest health. This includes implementing and monitoring a range of silvicultural and reforestation practices in order to be responsive to emerging issues and regenerate stands to a diversity of tree seedlings of good quality, form, and health (USDA-FS 2007a, p. 14).

Even-aged regeneration methods on the ANF continue to result in establishment of a diversity and abundance of tree seedlings, nearly always meeting silvicultural objectives. Conversely, initial implementation and monitoring results indicate that single tree selection will not result in diverse, desirable, and abundant tree seedlings, particularly without implementation of associated reforestation treatments. Group selection that incorporates 2007 Forest Plan design criteria for larger group opening sizes appears to be more effective in regenerating stands to a diversity of tree species and shade tolerance ranges than single tree selection treatments or those that utilize smaller group openings. However, additional implementation, monitoring and evaluation of uneven-aged treatments employing group selection is needed in order to more fully evaluate this monitoring item and to determine if refinements need to be made to silvicultural practices.

Recommendations – Continue monitoring seedling composition, stocking, cost and time to establish seedlings, species diversity, and overall treatment effectiveness in achieving desired structural and compositional vegetation conditions at various scales in areas managed using uneven-aged regeneration methods, particularly with regards to various group opening sizes used with uneven-aged management. It is also recommended that all single-tree selection harvests completed within the last 15 years receive an updated seedling stocking survey using current protocols to evaluate seedling establishment success, as part of a continued monitoring and adaptive management approach.

Forest overstory and understory composition

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
What is the forest composition (overstory and understory) in areas actively managed, as well as in areas with little active vegetation management?	Annual	5 years	A

Protocol – Overstory versus understory forest composition in areas actively managed and areas with little active management on the ANF was summarized using vegetation data in the FIA database (Morin pers. comm. 2014). Vegetation in actively managed areas was represented with inventory data from areas classed as non-reserved by FIA, while vegetation in less actively managed areas was represented with inventory data from areas classed as reserved. Reserved status is assigned by FIA to forest land withdrawn from timber utilization through statute, administrative regulation, or designation without regard to productive status. Examples include National Forest wilderness areas, National Parks, and National Monuments within areas classed as non-reserved, while five plots fell within areas classed as reserved.

Results

Volume of trees on non-reserved and reserved lands

Figure 50 displays the proportion of volume of tree species greater than five inches in diameter on non-reserved and reserved areas on the ANF in 2012. As measured by volume, black cherry is the most abundant tree species on the ANF on both reserved and non-reserved areas. Red maple is the second most abundant species on non-reserved lands, while sugar maple is the second most abundant species on reserved lands on the ANF. Oaks were only measured on non-reserved areas of the ANF, and northern red oaks are the fifth most abundant species in terms of overall volume. It should be noted that many less actively managed areas on the ANF are dominated by oaks, but this is not reflected in FIA data as those areas are not considered reserved by FIA.

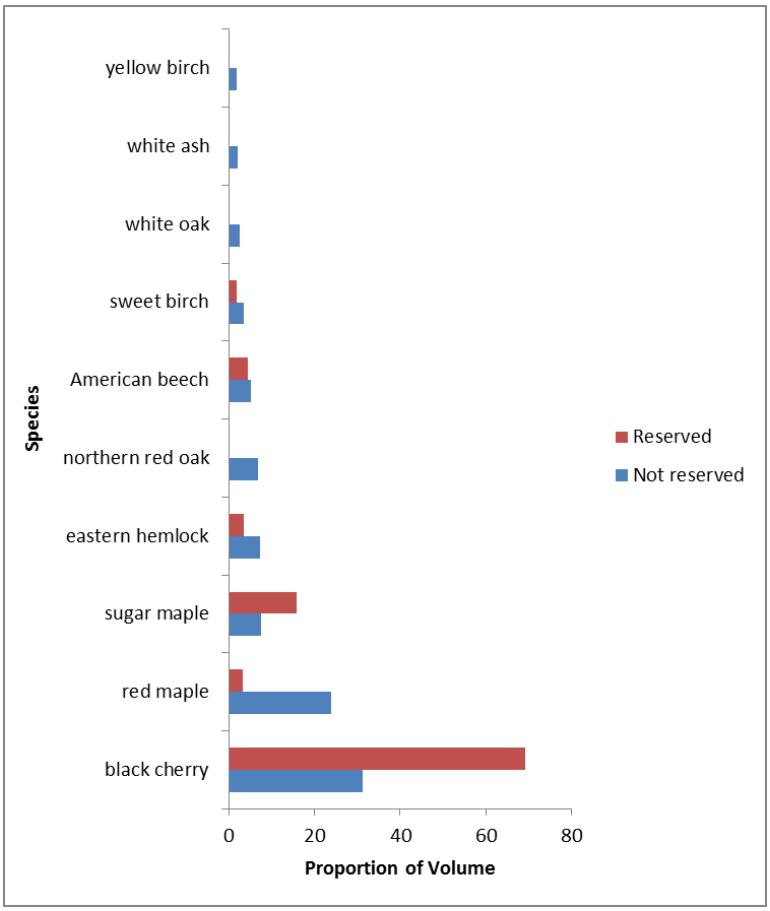

Figure 50. Proportion of volume of all live trees (5" and greater) on forest land by reserved status (FY 2012)

Proportion of live trees on non-reserved and reserved lands

Figure 51 displays the relative abundance of tree species as the proportion of live trees larger than one inch on non-reserved and reserved lands on the ANF. American beech comprises the largest proportion of trees larger than one inch on non-reserved lands on the ANF followed by black cherry. On reserved lands, black cherry comprises the largest proportion of trees larger than one inch, followed by sugar maple.

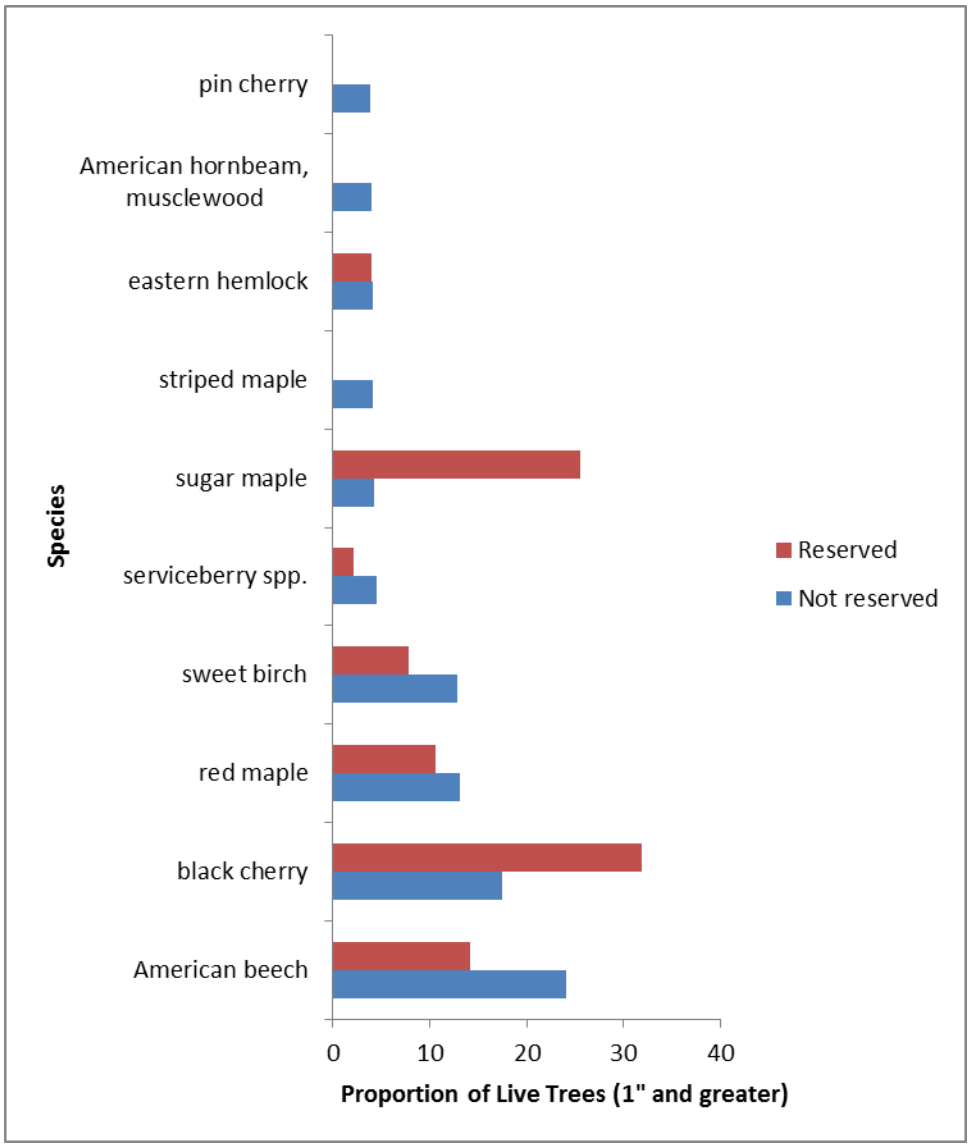

Figure 51. Proportion of live trees (1" and greater) on forest land by reserved status (FY 2012)

Proportion of seedlings on non-reserved and reserved lands

Figure 52 displays the relative abundance of tree seedlings on the ANF on both non-reserved and reserved lands. American beech is the most abundant tree species present in the seedling class, on both non-reserved and reserved lands on the ANF. In reserved (unmanaged) portions of the ANF, American beech comprises nearly 90% of the seedling composition. This is likely due the fact that American beech is tolerant of shade in forest understories as well as a result of the introduced BBD complex. When overstory beech trees die from the BBD complex, a root suckering response occurs with thickets of beech suckers developing (see *Changes in forest health*). Similar to the overstory trees that died, these genetically identical beech root suckers are also susceptible to the BBD complex.

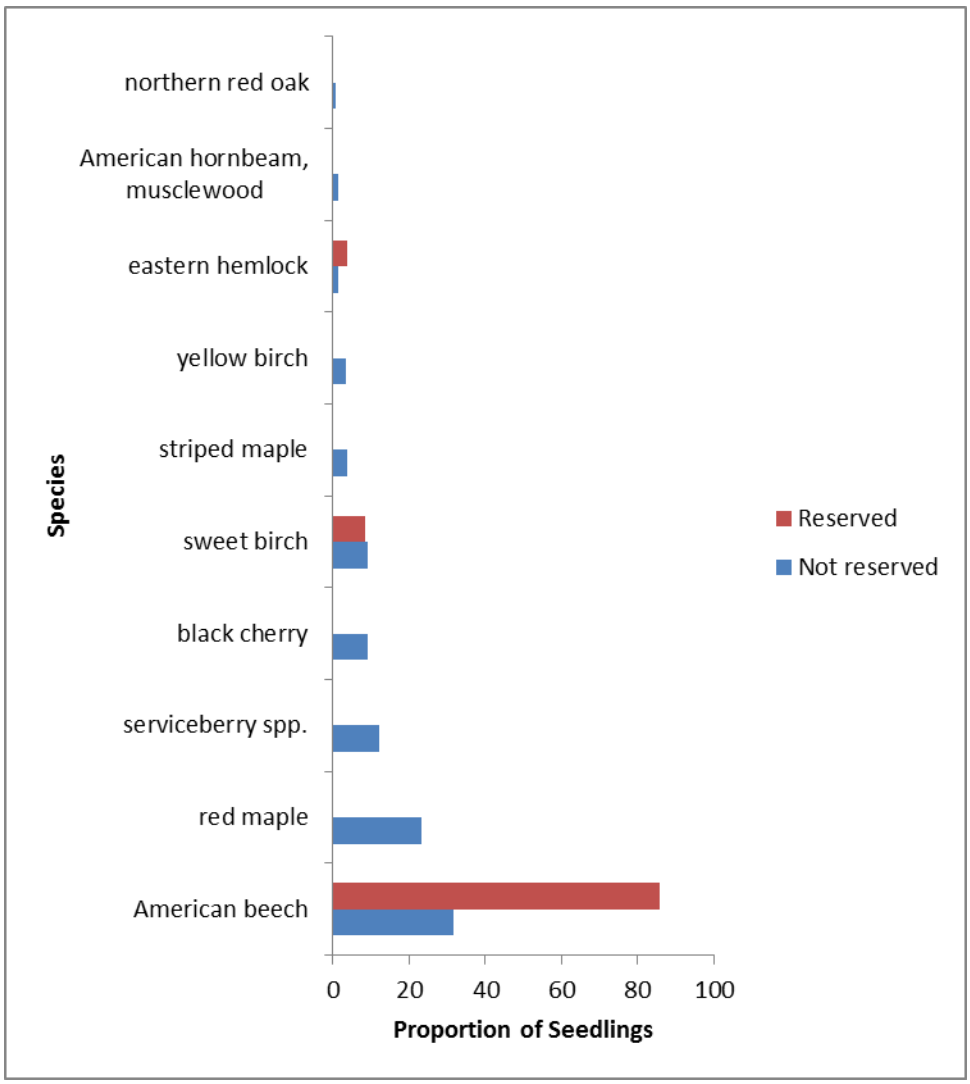

Figure 52. Proportion of seedlings on forest land by reserved status (FY 2012)

The abundance of American beech indicates that both reserved and non-reserved areas on the ANF will transition to a greater abundance of beech trees in the absence of management activities to promote establishment of tree seedlings of other species. The second most abundant tree seedlings on the ANF are red maples, which is consistent with many other areas in Pennsylvania. Oaks are the least abundant tree seedlings present on the ANF.

Conclusions – Forest Plan desired conditions include restoring understory vegetation and vertical diversity, where understory vegetation consists of multiple vegetative layers characterized by a diverse overstory, woody midstory, and well-developed understory of shrubs, herbaceous plants and tree seedlings. This enhances the resiliency of ANF ecosystems as understory vegetation and advance tree seedling regeneration can replace large overstory trees as they mature and die (USDA-FS 2007a, p. 11).

According to FIA data, the ANF contains an abundance of hardwood tree species with less abundant coniferous species interspersed. Several of these tree species are not as abundant in seedling size classes as they are in the overstory, in particular black cherry and oak species. On the other hand, American

beech is the 6th most abundant tree species in terms of overstory volume, yet comprises nearly 90% of tree seedlings on reserved (unmanaged) portions of the ANF. On non-reserved areas of the ANF, beech is the most abundant tree seedling. This suggests a general transition to greater dominance by American beech in the absence of intervention with a decline in the abundance of other tree species such as oaks and black cherry.

Based on forest inventory cycles completed in 2004, 2009 and 2012, there is not any detectable change in forest vegetation composition (Morin pers. comm. 2014); however, it is anticipated that changes in forest vegetation composition will occur over time as overstory trees die individually or from larger disturbances and established tree seedlings of other species are able to grow and replace existing forest overstory trees on the ANF.

Recommendations – Continue monitoring understory and overstory forest composition across the ANF in actively managed and unmanaged areas using various means, including FIA data.

Changes in forest health

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
What are significant changes in forest health? What threats to forest health are present?	Annual	5 years	A/B

Protocol – The following specific types of forest health monitoring occurred during the fiscal years between 2008 and 2013. Data collection adhered to standard agency protocol or FHM/FIA protocol. All collected information was stored in agency databases or in field notes. Monitoring activities included:

- Informal observations made by Forest field-going personnel;
- FHM/FIA forested land plot data collection from FY 1998 to FY 2013;
- Summer aerial detection surveys by FHP, PABOF, and Forest personnel;
- Field surveys conducted by FHP entomologists and pathologists, and Forest personnel; and
- Observations by PADCNR, PDA, and APHIS personnel.

Additional information on exotic forest pest species and their status nationwide can be found at www.aphis.usda.gov. The USDA-Forest Service Northeastern Area website (www.na.fs.fed.us) provides additional information regarding the current status of both native and exotic forest pests in the Northeastern United States.

An extensive discussion on forest health and threats to forest health can be found in the *Destructive insects and diseases* section of this report.

Results – In FY 2013, the ANF experienced significant gypsy moth defoliation with approximately 189,994 acres of detectable change in forest canopy vegetation identified (Figure 6, FDM data).

Also in FY 2013, the introduced EAB and HWA were both found for the first time on the ANF. In the absence of effective landscape-level controls for these species, high levels of eastern hemlock and white and green ash mortality are expected within the next couple decades on the ANF.

The BBD complex has been present on the ANF since the early 1980s and the killing front now covers the entire ANF. Similar to New England states, it is likely that American beech on the ANF will have perhaps 1-5% of the trees ultimately being resistant to the disease complex (Koch pers. comm. 2013). In other words, it is likely that over 90% of the mature American beech on the ANF will succumb to the disease complex over time, particularly given the lack of landscape-level controls presently available.

National Insect and Disease Forest Risk Assessment predicts that several tree species on the ANF are individually projected to experience substantial loss of basal area in the next 15 years due to exotic insects and disease introductions. These include oaks, ash species, eastern hemlock, American beech, maples, and pines.

- Oak species comprise approximately 9% of the ANF's basal area and are concentrated along major drainages across the Forest. The recurrence of destructive gypsy moth outbreaks throughout the Forest has caused, and has the potential to cause additional mortality of oak species on the ANF. There is likelihood for gypsy moth populations to build up again to a level that will require treatment in the future. Oak decline and oak wilt are other serious threats to the health of oaks on the ANF. The National Insect and Disease Forest Risk Assessment predicts the ANF could lose 18% of the oak basal area over the next 15 years.

- Ash species comprise approximately 2.5% of the overall basal area across the ANF. Substantial ash mortality is likely to occur over the next 10 years posing risk to forest health and public safety. The National Insect and Disease Forest Risk Assessment predicts the ANF could lose 29% of the ash basal area in the next 15 years. In total, near 100% loss of ash basal area is anticipated on the Forest.

- Eastern hemlock comprises approximately 10% of the overall basal area on the ANF, occurs across the entire Forest, and is largely concentrated in ecologically important areas, such as riparian zones. The current and continued spread of HWA is devastating this species of unique ecosystem value in the eastern United States, and high levels of hemlock mortality are anticipated in coming decades. The National Insect and Disease Forest Risk Assessment predicts the ANF could lose 31% of the overall eastern hemlock basal area in the next 15 years.
- American beech comprises around 8% of the overall basal area and occurs across the entire ANF. To date, we estimate that at least two-thirds of the beech basal area in the northern part of the ANF has died due to the introduced BBD complex, and we estimate less than 5% of the beech basal area will persist in the long term. The National Insect and Disease Forest Risk Assessment predicts the ANF will experience an additional loss of 17% of overall American beech basal area in the next 15 years.

- Sugar maple comprises around 8% of the overall basal area on the ANF and occurs across the forest. Maple decline is a serious threat to the health of maples in the northeast and is projected to cause an overall loss of 20% loss of sugar maple basal area on the ANF over the next 15 years.

- Pine species comprise 3.2% of the overall basal area on the ANF and occur as concentrated plantations, in small groups, or as scattered trees. Pine species on the ANF are threatened by SWW, which has been detected on other lands around the ANF. The National Insect and Disease Forest Risk Assessment predicts that the ANF may lose 3% of host species (pines) over the next 15 years.

Conclusions – In total, the species listed above comprise nearly 40% of the overall basal area of trees on the ANF. These species are critical to the biodiversity of the forest ecosystem on the ANF landscape. They are of high value to the sustainability of quality wildlife and fisheries habitats across the forest and associated watersheds.

Invasive insects and disease continue to be the most significant threats to the health of forests on the ANF. Recent introductions of HWA and EAB are of particular concern along with the continued presence of gypsy moth populations and continued mortality and changes in forest structure resulting from BBD. Additional questions regarding overall black cherry health are being investigated with researchers from NRS and may result in additional understanding of overall ANF forest health. Native defoliators that have caused significant defoliation and decline in the past also present the potential for significant changes in forest health. The most important of these include cherry scallopshell moth, forest tent caterpillar, and elm spanworm.

These factors alter natural disturbance regimes and change stand trajectories, changing forest composition, structure, and function. A number of management activities, projects, and strategies on the ANF are specifically designed to reduce impacts from destructive insects and diseases.

Recommendations – Continue insect and disease detection and monitoring activity as a cooperative effort with FHP. Maintain health of forest stands through integrated pest management strategies. Enhance the diversity of forest vegetation in terms of composition and structure in order to improve resiliency of the forest and reduce the level of impact from insects and diseases, particularly those that are introduced.

For those insects and diseases that present new threats to Forest tree species (such as EAB, HWA, and SWW), continue monitoring for their presence on the ANF and develop and implement strategies and action plans for these pests that integrate newly identified or state-of-the-art pest control techniques. Continue monitoring overall health and status of affected tree species.

Effectiveness of herbicide design criteria

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
How effective are herbicide design criteria in protecting water? To what extent are herbicides drifting into buffer areas? Are water quality protection criteria being met?	2-5 years	5 years	A/B

Protocol

General forest area

Visual monitoring was completed in a sample of areas that received broadcast herbicide treatment between FY 2007 and FY 2012 to determine if standards and guidelines specified in the Forest Plan to maintain water quality were being appropriately implemented and if they were effective.

A random sample representing a range of 10-30% of treated blocks was selected for monitoring. The sample included selections from both glyphosate and sulfometuron methyl mix treatment areas, and sulfometuron methyl only treatment areas. Overall, 20% of all areas treated with broadcast herbicide

between FY 2007 and FY 2012 were included in a random sample and monitored for implementation of adequate buffers along water features.

The entire perimeter of each sampled area was walked as well as the boundary of all buffer areas within treatment blocks, and a visual assessment of any herbicide injury or death of vegetation was completed. This visual assessment was used as an indirect measure of spray control to assess if herbicide stayed within each treatment block and to determine if any overspray or herbicide damage resulted within buffer areas.

The monitoring occurred one to two years following herbicide treatment, during July and August, when herbicide injury or death on plants was readily evident. Based on the appearance of targeted vegetation within treatment blocks, it was ascertained if similar herbicide damage occurred outside of any treatment blocks, or within any buffer areas. Where inconsistencies with Forest Plan standards were noted, a follow-up visit was conducted with the ANF Herbicide Contract Administrator, the Forest Hydrologist and/or the Forest Fisheries Biologist, and District personnel involved with herbicide treatment area layout and administration. The purpose of the follow-up visit was to reassess field observations and identify operational improvements to ensure Forest Plan standards and guidelines are correctly implemented.

13% Area

Seven areas treated with herbicides in FY 2011 that lie within the thirteen percent of the ANF that drains into the Allegheny River (13% Area) were monitored for specific riparian buffers. Monitoring of these seven areas occurred one to two months after treatment and focused on assessing buffers designated in the field for protection of water quality. Areas treated with herbicides within the 13% Area must maintain larger buffers than treatments on areas outside of the 13% Area (USDA-FS 2007a, p. 74-75 and 83).

Right-of-way herbicide application

Electric utility companies must manage vegetation beneath and adjacent to the electric conductors and structures on their rights-of-way (ROW) in order to provide safe, reliable electricity to its customers. These companies apply herbicides to control tall growing vegetation on sections of their ROW for electrical distribution and transmission across the ANF. Herbicide application on powerline utility corridors on the ANF was evaluated and approved in the Vegetation Management on Electric Utility Rights-Of-Way FEIS (USDA-FS 1997).

Part of the assessment for vegetation management in electric utility corridors included mitigation measures to protect water quality (USDA-FS 1997 pp. V-123 – V-125). Stream or wet area buffers were designed to protect vegetation within the buffer zone and to prevent herbicide entry into surface water. The buffer strategy described includes the following:

- No herbicide shall be applied within 10 feet of standing or flowing water.
- No picloram or triclopyr and no high-volume foliar application methods shall be used within 75 feet of standing or flowing water.

The FEIS also included a monitoring plan that called for a random visual sample of 10% of the stream or wet area buffers established in the treated areas.

During each of the buffer zone location visits, herbicide inspection forms were completed, photographs were taken, and GPS coordinates of each buffer zone sample site were taken.

Results

General forest area

Table 58 summarizes broadcast herbicide application monitoring of treatments that occurred between FY 2007 and FY 2012.

Table 58. Broadcast herbicide application monitoring summary (herbicide application occurred in FY 2007-2012 with subsequent monitoring in FY 2008-2013)

Fiscal Year Treated	Treated Acreage	Treated Areas	Fiscal Year Monitored	Stands Monitored	Water Buffers	Inadequate Water Buffers	Water Buffers with Herbicide Damage
2007	885	50	2009	11	6	1	0
2008	666	43	2009	9	4	1	0
2009	710	44	2011	11	2	1	0
2010	603	39	2011	12	2	0	0
2011	1,409.4	70	2013	8	1	0	0
2012	960	57	2013	8	2	0	0
Total	**5,233.4**	**303**	**2009-2013**	**59**	**17**	**3**	**0**

2007 treatment area monitoring – Of the 11 sampled stands from FY 2007 herbicide treatments, six contained buffers along streams. Five of these buffers exceeded Forest Plan standards for buffer widths to protect water quality during herbicide application. The sixth buffer was insufficient. A 50 foot buffer was established along an intermittent stream where water was flowing the day of treatment, consistent with Forest Plan standards. However, a 200 foot portion of this intermittent stream, where dry the day of treatment, should have had a buffer designated for 10 feet along both sides of the drainage. The dry portion of the drainage was indistinct with heavy fern and was likely missed during layout of the treatment block. No visible injury or death of vegetation from herbicide treatment was noted inside any designated watercourse or other buffer areas.

2008 treatment area monitoring – Of the nine sampled stands from FY 2008 herbicide treatments, four contained buffers along streams. Three of these buffers exceeded Forest Plan standards for buffer widths to protect water quality during herbicide application. The fourth designated buffer varied between three and 10 feet in width along an intermittent stream. This buffer should have been 10 foot wide along the entire length of the dry intermittent stream. No visible injury or death of vegetation from herbicide treatment was noted inside any designated watercourse or other buffer areas.

2009 treatment area monitoring – Of the 11 sampled stands from FY 2009 herbicide treatments, two contained buffers around water features. One of these buffers exceeded Forest Plan standards for buffer widths to protect water quality during herbicide application. The other buffer should have been larger in order to better protect a seep, even though it was dry at the time

of herbicide application. The area contains sphagnum moss, rushes, and violets. This area was visited by the Forest Fisheries Biologist and Forest Silviculturist, who followed up with District personnel regarding this stand. This wet area should be avoided or mitigated in next harvest entry and a logging plan prepared in advance for accessing the remainder of the unit. No visible injury or death of vegetation from herbicide treatment was noted inside any designated watercourse or other buffer areas.

2010 treatment area monitoring – Of the 12 sampled stands from FY 2010 herbicide treatments, two contained buffers around water features. Both buffers exceeded Forest Plan standards for buffer widths to protect water quality during herbicide application. One could have been widened to incorporate more wetland vegetation in the stand; however, the buffer width met Forest Plan standards for intermittent streams. No visible injury or death of vegetation from herbicide treatment was noted inside any designated watercourse or other buffer areas.

2011 treatment area monitoring –Of the eight sampled stands from FY 2011 herbicide treatments, one contained a buffer to protect water quality along a stream. The buffer width exceeded Forest Plan standards to protect water quality during herbicide application. No herbicide damage was observed within the buffer. No overspray was observed in any of the eight sampled stands.

2012 treatment area monitoring –Of the eight sampled stands from FY 2012 herbicide treatments, two contained buffers along streams. Both exceeded Forest Plan standards for buffer widths to protect water quality during herbicide application. No herbicide damage was observed within either of the buffers. No overspray was observed in any of the eight sampled stands.

13% Area

Seven areas were treated with herbicides in FY 2011 that lie within the thirteen percent of the ANF that drains directly into the Allegheny River (13% Area). All seven of these areas were reviewed in the field by the Forest Fisheries Biologist following treatment to assess buffer widths (Table 59). Four of these areas did not contain water features requiring a buffer. Three of these areas contained water features that were insufficiently buffered and did not meet Forest Plan guidelines for protection of northern riffleshell and clubshell mussels in the 13% Area. However, all but one of these areas had sufficiently sized buffers that were consistent with standards for protection of water quality in general forest areas during herbicide application.

Table 59. 13% Area broadcast herbicide application monitoring summary (herbicide application and monitoring both occurred in FY 2011)

Treatment Area	Water Feature	Required Buffer	Actual Buffer	Length of Water Section not in Compliance
5, 7, 20, 22/23	none	n/a	n/a	n/a
6	intermittent stream	50’ plus 2’ for every 1 percent of slope	28’-31’	approx. 100’-150’
25	vernal pool (20’ diameter)	100’ for heavy equipment and vegetation removal; 10’ if dry or 25’ if wet for herbicide application	50’-70’	approx. ¾ of vernal pool perimeter for heavy equipment
26	intermittent streams	50’ plus 2’ for every 1 percent of slope	15’-55’	approx. a few hundred feet
	spring/stream (assuming stream is perennial since being fed by spring)	perennial stream: minimum 100’, or 50’ plus 4’ for every 1 foot of slope, whichever is greater	30’-50’ as measured at three locations near the spring origin	approx. a couple hundred feet

Right-of-way herbicide application

2007 Right-of-way treatments – Four of the 34 buffer sites implemented in FY 2007 were randomly selected for inspection in the field in FY 2009. These buffers were implemented with application of selective low volume foliar application of herbicides in utility corridors. On August 13, 2009, the four sites were visited by representatives from the electric utility companies who applied the treatment as well as a silviculturist and the Forest Fisheries Biologist from the ANF.

Random sampling and field inspection of sampled sites near areas with standing or flowing water demonstrated that at least a 10-foot buffer zone was maintained during transmission and distribution ROW herbicides treatments.

2008 Right-of-way treatments – During July and August 2008, selective low volume and high volume foliar applications of herbicides were implemented to maintain desirable vegetation conditions in electric utility corridors on the ANF.

Seven of the 61 buffer sites implemented in FY 2008 were randomly selected for inspection in the field in FY 2009. The seven random samples for FY 2008 represented 11% of the total buffer zones for that year.

Visual inspection of seven buffer zones was conducted to determine any herbicide damage present on vegetation within any of the buffer zones. No evidence of herbicide damage on

vegetation was found within any of the seven buffer zone locations inspected. The effects of the herbicide application were noted outside of the buffer zones inspected.

2009 and 2010 right-of-way treatments – Four of the 38 buffer sites where herbicide was applied in FY 2009 and FY 2010 were randomly selected for inspection in the field. On July 14, 2011, four randomly chosen buffer zone locations were visited by representatives from the electric utility companies who applied the treatment as well as a silviculturist and the Forest Fisheries Biologist from the ANF. Selective low volume foliar or stump treatments were applied at these sites. All randomly selected buffer zones near areas with standing or flowing water demonstrated that at least 10-foot buffers were maintained during the treatments.

Conclusions – Instances of insufficient buffers along water features are relatively few and have been declining since implementation of the 2007 Forest Plan began. Between FY 2007 and FY 2012, 5,233.4 acres (303 sites) were treated with broadcast herbicide applications on the ANF. Of the 303 sites, 59 stands (20%) were randomly selected to monitor buffers applied during herbicide treatment. The 59 sampled stands contained 17 water features with buffers designated on the ground to protect water quality during herbicide application. Of the 17 buffers, 14 were sufficient and met Forest Plan standards for protection of water quality during herbicide application. Three were insufficient, and occurred during FY 2007-2009 herbicide application. Two were insufficient or lacking buffers along dry intermittent streams. The third contained a seep that should have been included in nearby reserve areas. All water features present in areas treated with herbicides between FY 2010 and FY 2012 were sufficiently buffered and met Forest Plan standards for protection of water quality during herbicide application.

The requirement for buffering of intermittent streams and spring seeps that are dry during herbicide application was new with implementation of the 2007 Forest Plan. Monitoring early on indicated a need to improve intermittent stream identification skills and ensure appropriate buffers were delineated in the field. Since implementation of the 2007 Forest plan began, specialists have been working with District contract administrators to ensure dry intermittent streams are properly identified and protected during layout of buffers, and that buffer widths are consistent with Forest Plan standards. Follow up with District staff has occurred following buffer monitoring and field visits occurred where necessary to identification include laying out treatment area boundaries in the spring, prior to leaf out, when less well defined water features are more evident.

Requirements for larger buffer widths within areas that fall within the 13% Area were overlooked by District staff and did not meet Forest Plan guidelines for protection of northern riffleshell and clubshell mussels; however, all but one of these areas had sufficiently sized buffers that were consistent with standards for protection of water quality in general forest areas during herbicide application, so no effect to mussels is predicted.

As a result of this monitoring, the Forest Silviculturist and Forest Fisheries Biologist followed up with District staff and contract administrators to reiterate special guidelines relative to herbicide application within the 13% Area. Additionally, a comprehensive table comparing vegetation management, equipment, and herbicide limitations within wetland management zones and riparian corridors within the 13% Area and the remainder of the ANF was developed early in FY 2012 and distributed to ANF silviculture, timber layout and marking, and herbicide contract administration staff. This table consolidates related Forest Plan standard and guideline information from the different sections: 2150

(Environmental Management), 2500 (Watershed and Air) and 2600 (Wildlife, Fish and Sensitive Plant Habitat).

The findings of the ROW monitoring showed that the mitigation measures were being followed and that buffer widths specified in the FEIS are adequate in size as no evidence of herbicides reaching or entering any water courses was found.

Recommendations – Continue monitoring representative samples of herbicide treatment areas to ensure Forest Plan standards and guidelines relative to herbicide application are being implemented. Also operationally:

- Continue to ensure personnel laying out herbicide treatment boundaries and surveying sites for water or other sensitive features pay particular attention to less obvious water features that are dry at the time of treatment, such as intermittent streams, in order to ensure they are adequately buffered per Forest Plan standards.
- Continue to provide training, if necessary, for contract inspectors in the identification and delineation of intermittent streams.
- Strive to lay out smooth treatment area boundaries without sharp corners that the equipment operator is unable to navigate.
- Ensure adequate flagging is hung to indicate treatment area and buffer boundaries, particularly where heavy understory vegetation and brush is present. This includes hanging flagging as high as possible, with long streamers where heavy brush exists.
- Layout personnel should strive to walk unit boundaries prior to vegetation leafing out in order to better see water features, pipelines, and other features that should be avoided during treatment.
- Layout personnel need to survey for water features that fall within 100' of the treatment area boundary, to ensure they are properly buffered even if they fall outside the treatment area boundary.
- Ensure herbicide contract inspectors document condition of buffered water features at the time of treatment. Due to variable soil and climatic conditions, it is difficult to conclude whether a buffered feature was dry or contained flowing water at the time of treatment if not documented.

Watershed and Air

Status of water quality

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
What is the status of water quality on the ANF?	Annual	5 years	A/B

Protocol – Water quality data on the ANF is collected by Forest staff during various site surveys and fish sampling. State and federal agencies also collect water quality data on the ANF along with Conservation Districts and Trout Unlimited (TU) chapters. Information was gathered from internal and external sources to determine the status of water quality on the ANF.

WINs Coalition partners

The development of Marcellus extraction activities on public lands prompted WINs coalition partners to initiate a three-tiered program to help monitor activities and protect important water resources where needed. The first effort (Tier I) in the initiative was the deployment of TU trained Coldwater Conservation Corps volunteers to monitor local watershed activities in the region. In addition, more intensive water quality monitoring was conducted in the ANF through the operation of a network of stations in smaller sub-watersheds using data loggers (Tier II) and in larger basins using permanent multi-parameter real-time stations (Tier III) in areas targeted for Marcellus development. The monitoring approach was based on the successful network currently in use in the Susquehanna River watershed by the Susquehanna River Basin Commission.

In support of these efforts, the Colcom Foundation provided grants to the Iron Furnace Chapter of Trout Unlimited (IFTU), ECCD, and McKean County Conservation District (MCCD) to continue monitoring water quality in at-risk watersheds. In FY 2013, IFTU began working with the West Virginia Water Research Institute via the Three Rivers Quest Program to sample at ten locations in the Upper Allegheny Basin. The Three Rivers Quality Useful Environmental Teams (QUEST) initiative, given the acronym 3QR, is a water quality monitoring and reporting program for the Northern Allegheny River Basin. These data will supplement data collected by Duquesne University in the Lower and Middle Allegheny and by Wheeling Jesuit University in the Monongahela Basin. This project is also funded by the Colcom Foundation.

The 3QR program is split into four geographical regions: Northern Allegheny, Southern Allegheny, Upper Ohio, and Monongahela. In each region a mini-grant program was established to help facilitate the routine collection and sharing of water quality data by nonprofit organizations. The purpose of this program was to facilitate a regimented and continuous collection and sharing of water quality data in the Upper Ohio River Basin. MCCD applied for and was awarded a 3QR QUEST mini-grant administered by IFTU. Water quality data loggers were deployed in streams where drilling operations were occurring and/or were planned, including headwaters located on the ANF (Figure 53):

- MCCD currently has 16 Solinst data loggers with 10 deployed throughout McKean County.
- IFTU collected 3RQ grab samples at 11 locations in FY 2013, but only five in or nearby the ANF (Allegheny River at West Hickory, Tionesta Creek at Lynch, Tionesta Creek at Tionesta, Clarion River at Ridgway, and Clarion River at Cooksburg).
- Satellite Stations: IFTU has four of these within the ANF (Millstone Creek, Salmon Creek, Spring Creek, and Tionesta Creek). The real-time results of this monitoring can be viewed at ironfurnacetu.net. ECCD set up 11 real-time monitoring stations in municipal drinking water watersheds, including Big Mill Creek on the ANF, and 12 data loggers throughout Elk County.
- Streams that have had logger deployments: IFTU and the mini-grant partners (ECCD, MCCD, and WCCD) have loggers throughout ANF.

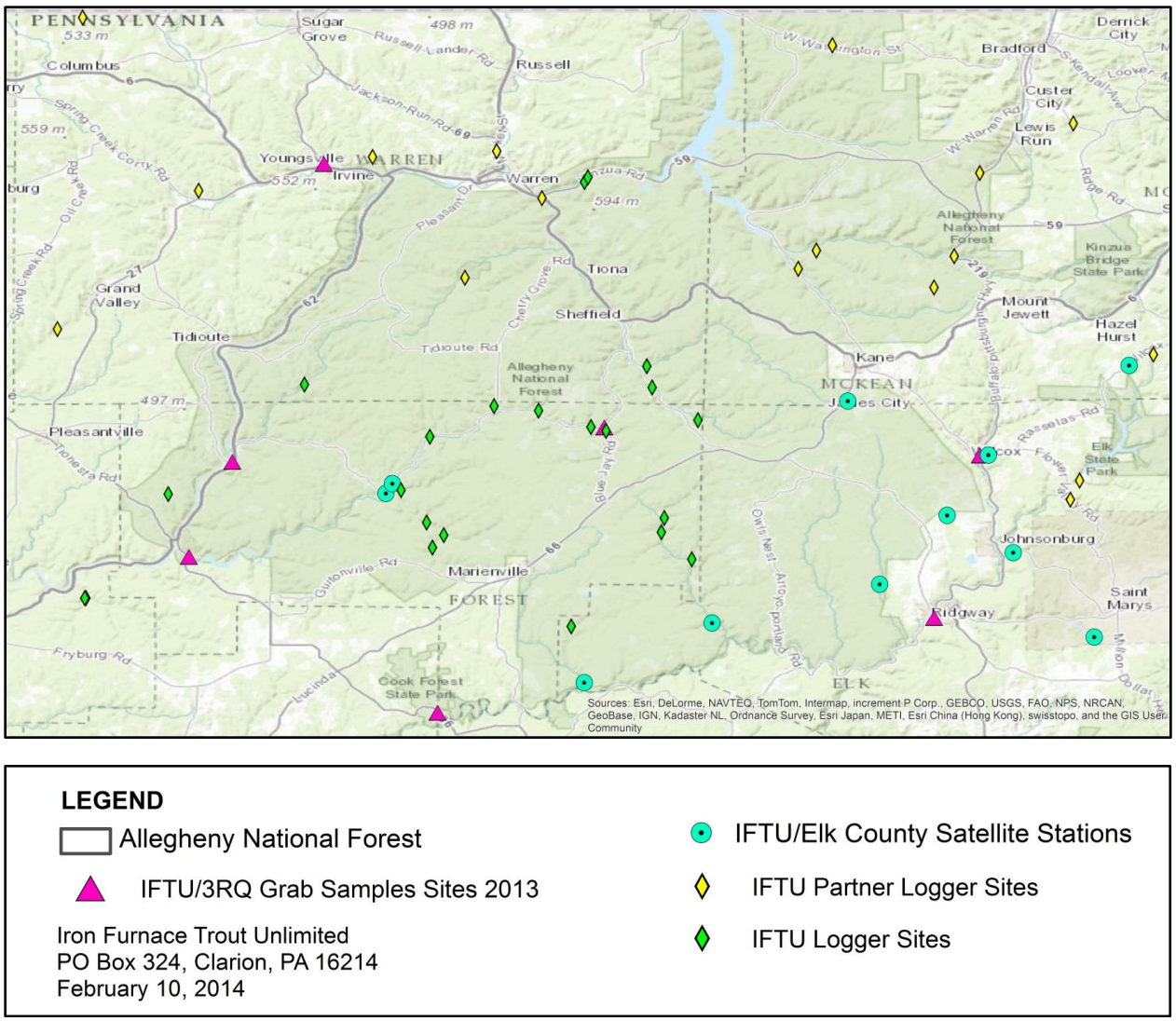

Figure 53. Location of water quality monitoring completed by partners in or near the ANF (IFTU)

Currently, these data are reviewed for indicators of pollution events, but not all of the data have been summarized or analyzed. When problem sites were identified, e.g., spikes in conductivity values or significant storm flow pH declines, follow-up occurred with the PADEP and PFBC. These data will eventually be stored in the appropriate database (e.g. EPA Storet) so that it can be used for baseline data. In addition, the Forest Service has a database for water temperature data that will be used for analysis of effects from climate change.

Elk County acid precipitation water quality study

In the spring of 2008 and 2009, chemistry, habitat, and macroinvertebrate sampling was completed by PADEP on 20 streams located in the Clarion River Watershed (located in the Ohio River Basin) in Elk County, Pennsylvania. In the fall of 2012, 17 of those sites were resampled by PADEP and ECCD to determine if the acidification present in many of the streams sampled is caused by acid precipitation or from another source. Sites with an IBI (see *Aquatic invertebrates – population trends*) score of 63 or

less (or close to it) both in the spring and in the fall samples were further examined by analyzing for dissolved aluminum. If the samples contained dissolved aluminum in concentrations over 150 mg/L, acid precipitation can be accredited for the source of the acidification problem.

All of the streams sampled but one (Lost Run) are located in the ANF. The following streams sampled are located in:

- Spring Creek Township: Cole Run (Stream Code 50178), Crow Run (Stream Code 50177), UNT to Bear Creek (Stream Code 50208), Davidson Run (Stream Code 50199), Crooked Run (Stream Code 50198), and Little Otter Run (Stream Code 50206).
- Millstone Township: Millstone Creek (Stream Code 49935), Winlack Run (Stream Code 49938), Wyncoop Run (Stream Code 50012), Steck Run (Stream Code 49998), Jakes Run (Stream Code 49988), Log Run (Stream Code 49979), Sugarcamp Run (Stream Code 49977), and East Branch Millstone Creek (Stream Code 49974).
- Ridgway Township: Pine Run (Stream Code 50437).
- Highland Township: Three Mile Run (Stream Code 50144).
- Fox Township: Lost Run (Stream Code 50397 for Sawmill Run UNT to 102667563).

Clarion University of Pennsylvania – oil and gas development effects on similar, adjacent watersheds

In 2010, a study was conducted to compare the benthic macroinvertebrate communities in the Hedgehog Run and Grunder Run watersheds. While these two adjacent watersheds are similar in size and topography, the Hedgehog Run watershed has very little OGD and the adjacent Grunder Run watershed has extensive OGD. Monthly kick-net samples were collected from slow and fast riffles at two sites from April to October. Water quality parameters, including pH, conductivity, temperature, dissolved oxygen, alkalinity, and total hardness were also collected. Turbidity measurements were collected by USGS water gauging stations in Grunder and Hedgehog every 15 minutes from June through October.

In addition to the 2010 sampling, this study reviewed previous surveys to provide insight on the history of the trends in water quality and the macroinvertebrate community of Grunder Run.

US Geological Survey – sediment study

The Forest Service received funding from the National Energy Technology Laboratory in 2009 to fund various studies on the ANF. One of these projects funded the USGS to analyze sediment load in Grunder Run and Hedgehog Run. While these two adjacent watersheds are similar in size and topography, the Hedgehog Run watershed has very little OGD and the adjacent Grunder Run watershed has extensive OGD (Table 60).

Grunder Run is located in a 3,171 acre watershed and has extensive OGD, dirt and gravel roads, and off-highway vehicle trails. Approximately 84% of the drainage (2,657 acres) is managed by the Forest Service. At the time of the study, there were 5.4 miles of mapped streams, one stone pit, and 412 recorded oil and gas wells (based on GIS) in the drainage and there had been no timber harvest activity on NFS land since 2000. Many of the non-system roads in the Grunder Run watershed used for OGD were constructed in the early 1980's by private oil and gas operators.

Hedgehog Run is primarily located in the Allegheny National Recreation Area and has almost no land-disturbing activity where NFS land is located in the 2,758 acre watershed. AT the time of the study, this watershed had 6.8 miles of perennial and intermittent streams and 27 oil and gas wells (based on GIS).

Table 60. Comparison of total road mileage and road density within the Grunder Run and Hedgehog Run drainages, based on GIS.

Drainage	Year	Acres	All Roads on all Ownerships		All Roads within 300' of a Stream on all Ownership		Forest Service Roads on all Ownership (Miles)	Forest Service roads within 300' of a stream (Miles)
			Total Miles	Road density (Miles/Mile^2)	Total Miles	Road density (Miles/Mile^2)		
Grunder Run	Oct. 2006	3,171	44.0	8.9	4.5	0.9	0.9	0.0
	April 2009		52.4	10.6	5.2	1.1	4.2*	0.0
	Nov. 2010		55.7	11.3	6.4	1.3	4.5	0.0
Hedgehog Run	Oct. 2006	2,758	9.0	2.1	0.2	0.1	1.0	0.0
	April 2009		8.6	2.0	0.1	0.1	1.0	0.0
	Nov. 2010		10.1	2.4	0.2	0.1	1.0	0.0

*This was not the result of new road construction between October 2006 and April 2009, but the result of a recalculation of miles in GIS.

The Forest Service collected 60 water samples in Grunder Run and 59 samples in Hedgehog from 2000-2007 (an average of six to seven samples per year) during high flow periods of which there were 52 sample pairs from the same storm event. USGS sampling began May 2010 and ended December 2010. They established two streamflow gages to measure continuous discharge and turbidity, and conducted manual and automatic sediment sampling. Due to a loss in project funds, USGS sampling did not continue past December 2010; however, since then, relatively few runoff events occurred that warranted collections for analysis of sediment concentration.

Pennsylvania Department of Environmental Protection – Aquatic Biology Investigation

In 2013, PADEP examined 24 streams from six drainages across a variant of geologic formations to determine if they are impacted by natural acidification or acid deposition. Spring and fall macroinvertebrate surveys were conducted along with aluminum concentration sampling. In addition, the study sought to determine if impacts from acid deposition were enough to merit aquatic life use impairments. Per PADEP, acid deposition aquatic life use impairment occurs when aquatic life appears to be depressed in a stream year-round from acidification. The stream should also exhibit dissolved aluminum concentrations greater than 150 ppb during high flows to conclude acidification is from precipitation, not due to natural conditions.

Results

WINs Coalition partners

Figures 54 – 56 represent water chemistry data from 11 stream locations. Differences in alkalinity were observed between sites in watersheds draining glaciated land types verses sites in watersheds draining unglaciated land types (Figure 54). Sulfate levels were low in most streams except in the Clarion River which may be due to acid mine drainage located in the watershed but off the ANF (Figure 55). Specific conductivity values were low for the sites in Tionesta Creek, but much higher on the Clarion River (Figure 56).

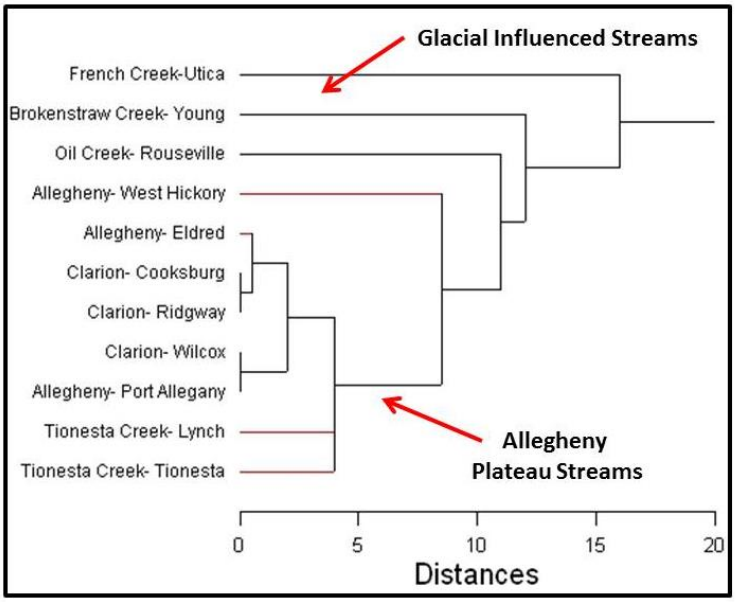

Figure 54. Comparison of alkalinity (mg/l as $CaCO_3$) at 11 sites in the upper Allegheny basin (January – December 2013; Bruce Dickson, IFTU)

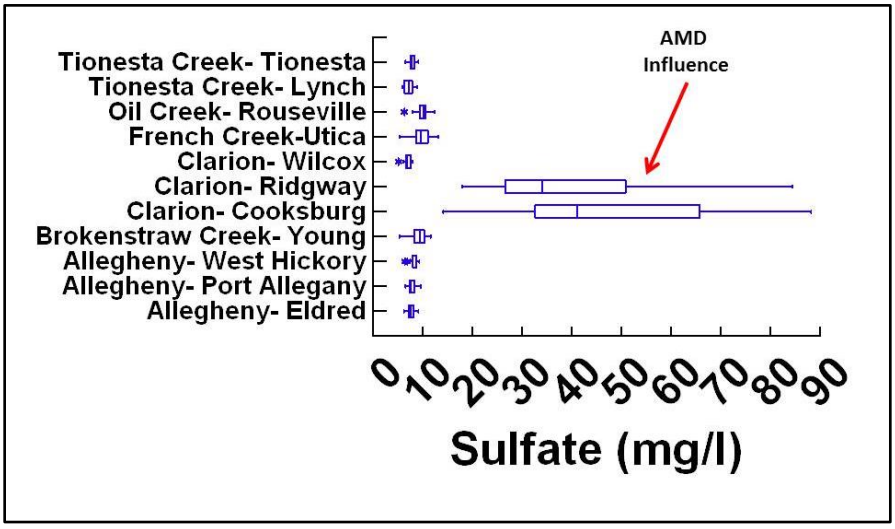

Figure 55. Comparison of sulfate values (mg/l) at 11 sites in the upper Allegheny basin (January – December 2013; Bruce Dickson, IFTU)

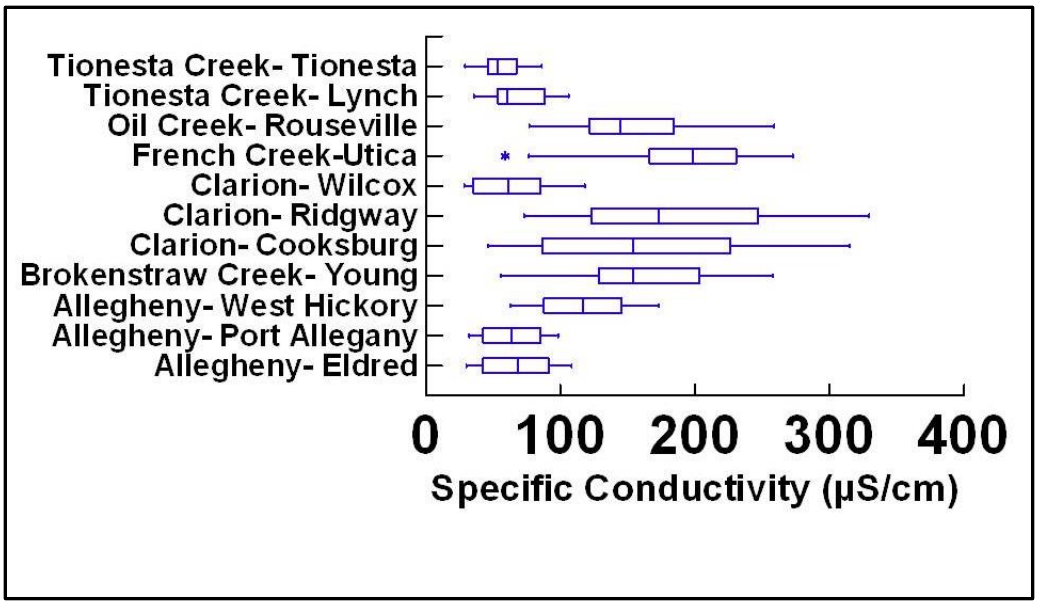

Figure 56. Comparison of specific conductivity (µS/cm) at 11 sites in the upper Allegheny basin (January – December 2013; Bruce Dickson IFTU)

A stream pollution event was documented on Hunter Creek in July during routine site evaluation for a large wood project. American Refining Group has a waterflood project in this area and one of their lines began discharging brine into the stream. PADEP followed up to test the discharge behind well WT 3664 07 (047-21912) from the pipe/line on July 18, 2012. Specific conductivity exceeded water quality standards at 2640.00 µS/cm. Total dissolved solids was 2,064 ppm, chloride was 817.3 ppm, and manganese was 240 ppb. Methane was 12.0 ppb, ethane 12.4 ppb, and propane was 14.2 ppb.

Hunter Creek was sampled again on August 30, 2012, at 12:30pm (water temp-14.4ºC, pH-6.9, conductivity- 679 µS/cm). On this date, ECCD placed a continuous meter in this stream to monitor fluctuations in conductivity. Streams in this area usually have a conductivity value less than 100 µS/cm, but this stream was much higher. The water quality standard for conductivity is 1,000 µS/cm. This stream had a short exceedence of this value for four days in October 2012 (Figure 57). Sometime in late October, it appeared the problem was corrected. By January, conductivity was measuring 104 µS/cm. Site reviews conducted during the course of the sampling noted sediment covering the bottom of Hunter Creek.

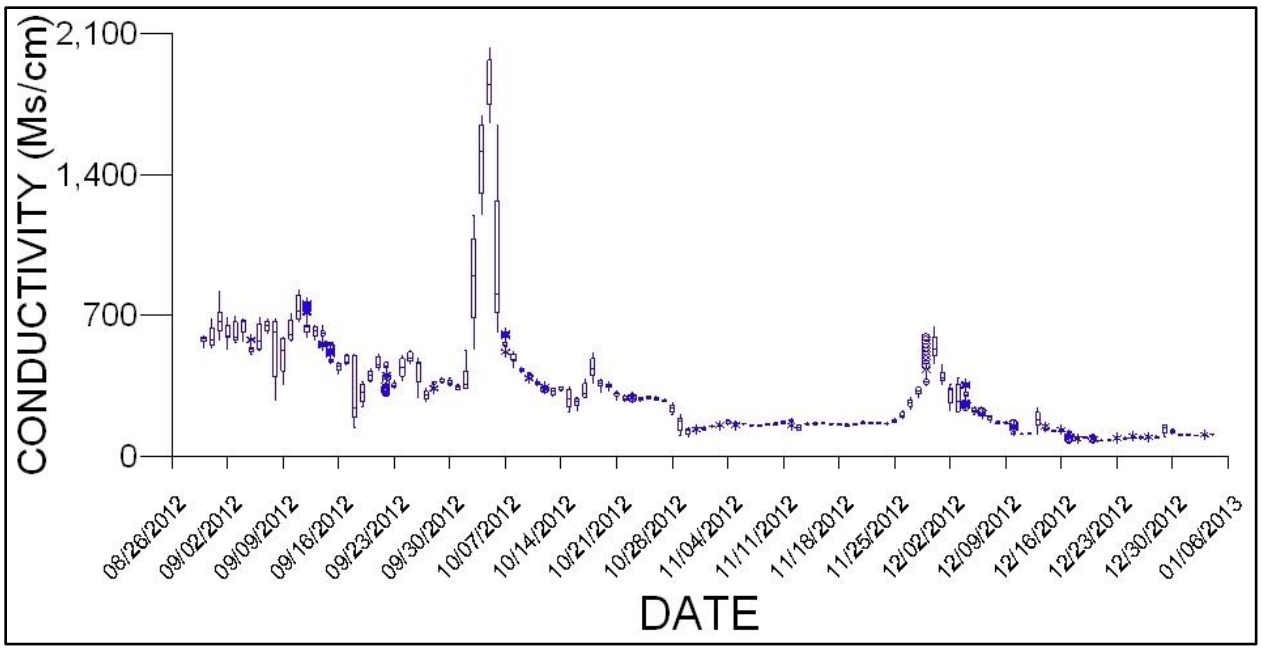

Figure 57. Specific conductivity (µS/cm) in Hunter Creek (August 28, 2012-January 8, 2013; ECCD)

Elk County acid precipitation water quality study

Of the 17 streams sampled in the Clarion River Watershed, 71% of the streams were found to be impacted by acidification with another 12% found to be partially impacted by acidification (Table 61). All of the affected streams (83%) lie within the ANF. In the 2008-09 sampling, the pH ranged from 4.8 to 6.5 with an average of 5.3. In the 2012 follow-up sampling, the pH ranged between 4.79 and 7.30 with an average pH of 5.8. Only four of the streams in both studies showed a neutral pH while all others were acidic in both the spring and fall. Water chemistry readings from both biological assessments indicated low alkalinity concentrations (0-10 mg/l) and low conductance values (26-130 µS/cm). Habitat sampling showed 14 sites were optimal and 3 sites (Three Mile Run, Crooked Run, and Little Otter Run) were suboptimal (Bonfardine 2014).

Table 61. Number of streams in the Elk County water quality study impacted by acidification

	# of Streams	Percent of Streams Sampled
Not Impaired	2	12
Impacted by Acidification	12	71
May be Impacted	1	6
Somewhat/partially Impacted	2	12
Total	**17**	**100**

Clarion University of Pennsylvania – oil and gas development effects on similar, adjacent watersheds

Between the 1982 and 1984, water quality as well as macroinvertebrate abundance and diversity surveys showed great improvement, "the macroinvertebrate community is more diverse, has higher abundance,

and contains more sensitive taxa such as Trichoptera than when compared to the 1982 survey" (Harris 2011b). Hardness and conductivity had decreased from an average hardness of 107 ± 7ppm to 62 ± 3ppm and an average specific conductivity of 630 ± 28µS/cm to 268 ± 21µS/cm (Harris 2011b).

The 1993 and 1994 survey reports showed Grunder Run showed continued, but slight improvement with a few more taxa and slightly higher abundances (Harris 2011b).

Surveys completed by Clarion University of Pennsylvania in 2008 found considerably more taxa with much higher abundances; however, this study also had a much higher sampling effort than the previous studies, thus they could not directly compare them (Harris 2011b). Water quality measurements showed an average alkalinity of 32 ± 4mg/L and an average specific conductance of 112.5 ± 30.3µS/cm, which is much reduced from the 1985 study (Harris, 2011b). Also, a much greater richness and abundance of taxa was identified, most likely due to the increased sampling effort.

The 2010 surveys measured a slightly higher average hardness (47 ± 27mg/L) and average specific conductance (136 ± 47.3µS/cm). These slightly higher levels did not exceed limits that are harmful to aquatic life. See *Aquatic invertebrates – population trends* for additional results from the macroinvertebrate sampling conducted in 2010.

US Geological Survey sediment study

The USGS estimated sediment loads and yields combined Forest Service and USGS data. Greater sediment load and yield occurred at Grunder Run (Figure 58 and 59). The limited data suggest sediment yields at both sites are indicative of predominately forested basins when compared to other sediment load data throughout Pennsylvania (Figure 60); however, the sediment yield in Grunder Run is the highest when compared against other forested watersheds.

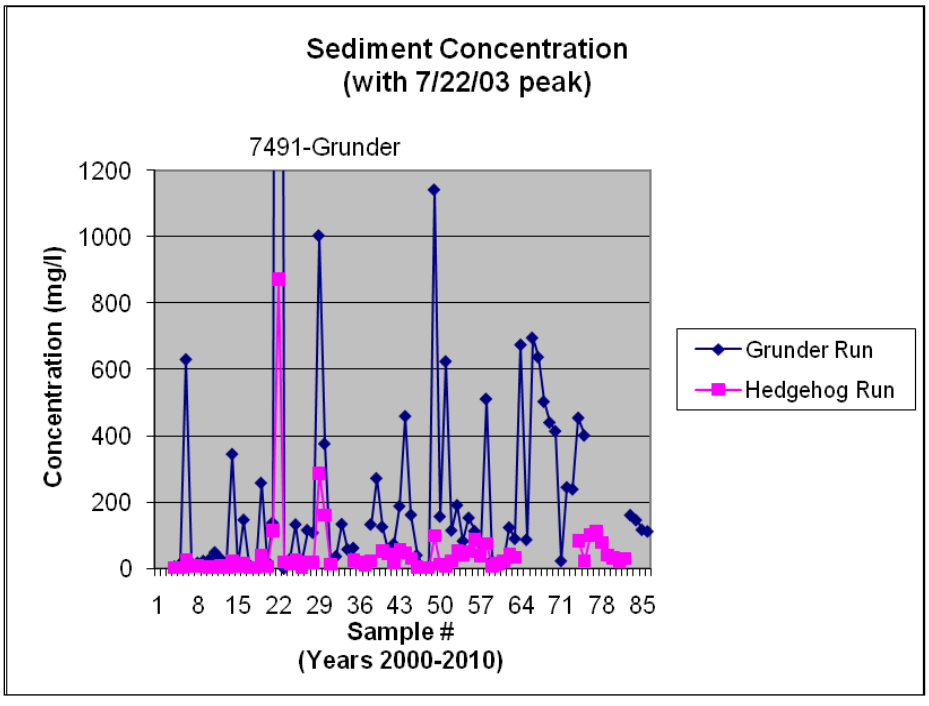

Figure 58. Sediment concentrations from water samples taken from Grunder Run and Hedgehog Run (2000-2010)

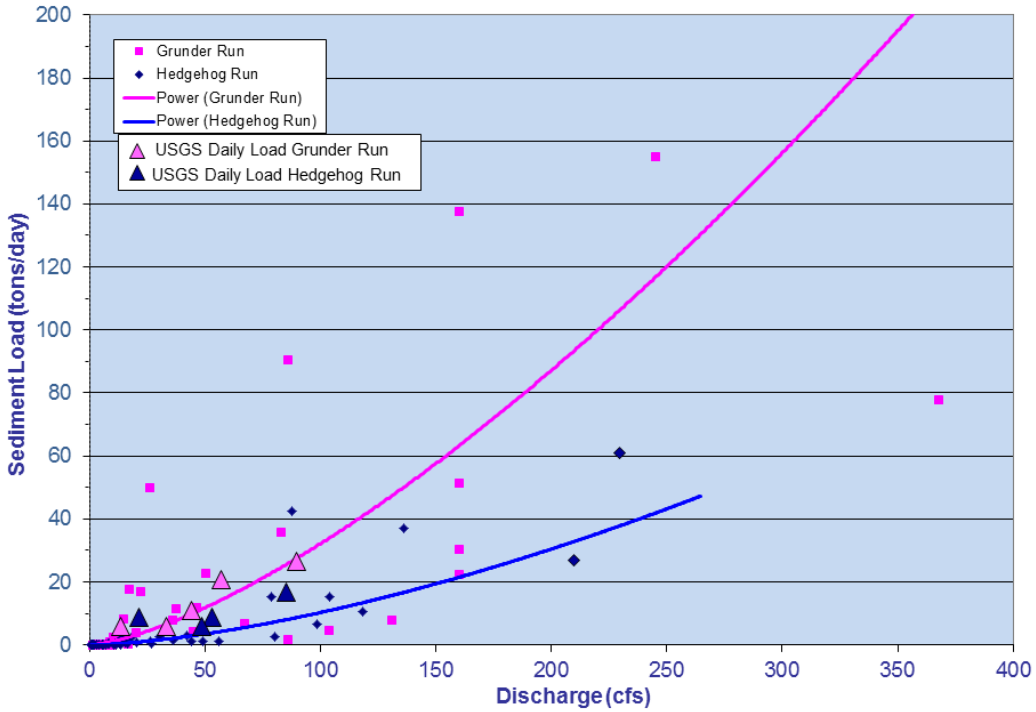

Figure 59. Comparison of sediment load in Grunder Run and Hedgehog Run

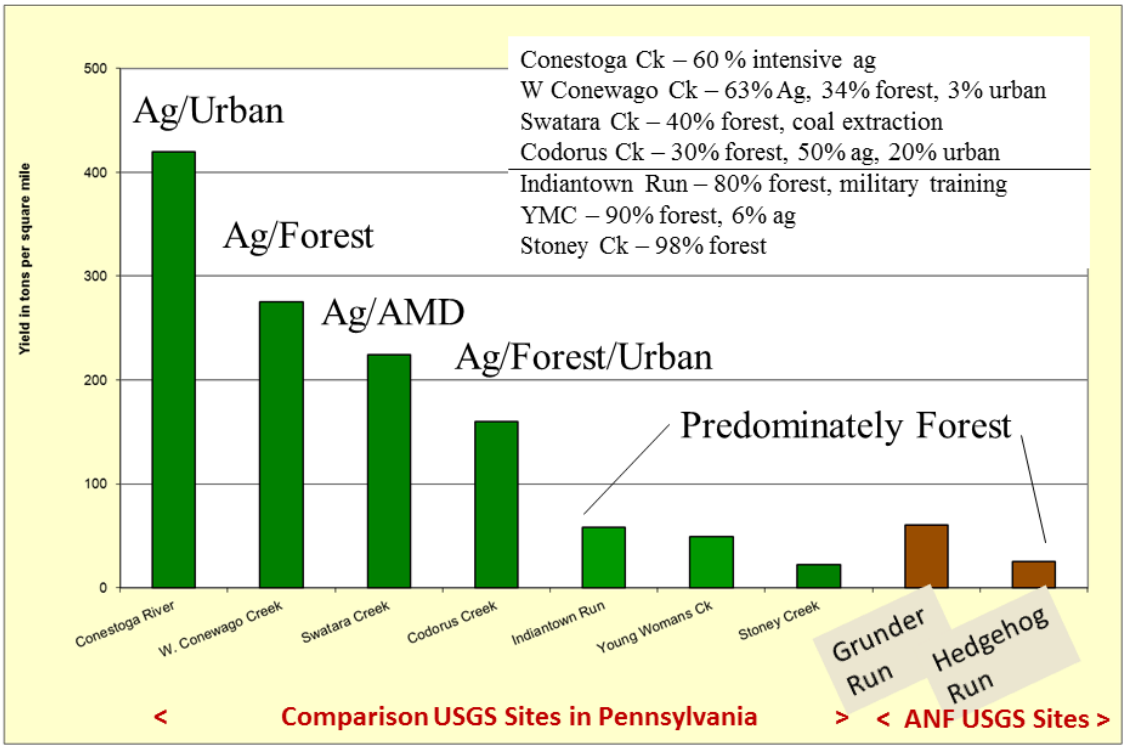

Figure 60. Comparison of sediment yield in drainages with various levels of disturbance throughout Pennsylvania

Pennsylvania Department of Environmental Protection – Aquatic Biology Investigation

Six streams had dissolved aluminum concentrations greater than 150 ppb during spring snow melts and rain events. Five of these six streams (Rocky Run, Cherry Run, an upper reach of Big Mill Creek, Bloody Run, and Pine Run) have been added to Category 5 of the Integrated Water Quality Report (IWQR) in need of a total maximum daily load for the source and causes of "Atmospheric Deposition - pH" and "Atmospheric Deposition - Metals". Additionally, the source of impairment for Gurgling Run, which was added to Category 5 of the IWQR in 2003, was changed from "Natural Sources" to "Atmospheric Deposition", with the causes of "pH" and "Metals".

While the other 18 streams are likely impacted by acidification to varying degrees, they were not enough to be considered impaired. They will be added to Category 1 or 2 of the IWQR as attaining their designated aquatic life uses.

An additional PADEP survey in the Clarion River basin indicates that seven additional streams on the ANF will likely be listed as impaired due to acid deposition once data collection is complete. Most of these streams have alkalinity of < 2 and pH < 5.0 in the spring.

See *Aquatic invertebrates – population trends* for additional results from the macroinvertebrate sampling conducted.

Conclusions – Data collected by TU and Conservation County District partners indicate that Tionesta Creek and Clarion River have low levels of alkalinity related to the unglaciated geology in the watershed. The sulfate and conductivity levels in the Clarion River are still impacted by acid mine drainage, but water quality is much improved compared to historic levels. The monitoring of conductivity has proven to be a valuable tool for the identification of brine leaks from OGD.

Water chemistry readings from biological assessments conducted in Elk County showed low alkalinity concentrations (0-10 mg/l) and low conductance values (26-130 µS/cm); both characteristics are typical for streams on the ANF. The reduced buffering capacity of the surface water makes the entire watershed vulnerable to sporadic low pH values stemming from heavy rain events and runoff from spring snowmelt. Continual acidification and low alkalinity is certainly a threat to these streams and will have toxic effects on the aquatic life. It was concluded that the water chemistry is and will be the most probable future stressor to the health of the streams and watersheds.

The main issue for the slightly lower habitat scores at Three Mile Run, Crooked Run, and Little Otter Run in Elk County were low scores in embeddedness and sediment deposition. This sedimentation is likely related to roads depositing silt and sediment in streams. Overall physical habitat scores were slightly better than overall IBI scores for macroinvertebrates indicating that aquatic habitat is not the limiting factor in streams. Water quality is more limiting for macroinvertebrates in numerous streams due to low pH and alkalinity.

The majority of streams on the ANF are meeting state water quality standards. Impairments are most frequently related to acid deposition or acidity from natural sources. This is typically only causing impairments on 1st or 2nd order streams, while the mainstem of streams have reduced productivity, but are not impaired. Larger streams are lower on the landscape and likely are recharged by groundwater with more buffering capacity. Additional pH and alkalinity data collection will provide supporting information for the evaluation of water quality.

The study of Grunder Run and Hedgehog Run watersheds revealed that sedimentation is higher in the oil and gas impacted watershed compared to a watershed with very low development; however, the macroinvertebrate studies did not detect a negative impact to water quality from this development. Due to the increased sediment load in Grunder Run compared to Hedgehog Run, remediation of roads in this watershed is needed to reduce sediment loads.

Other impairments have been related to the Chappel Fork oil spill or the nutrient impairments to Dutchman Run. The Chappel Fork oil spill is expected to return to normal levels once the oil deposits are flushed from the stream system. Dutchman Run is impaired due to septic discharges, but now that the Warren waste water treatment has extended into Clarendon, this nutrient loading should cease and water quality and macroinvertebrates are expected to return to normal levels. These impairments are temporary and will be removed from the impairment list once their water quality improves.

Recommendations

- The water quality data collected by partners should be stored in the appropriate depository so that it can be used for baseline data.
- Continue to monitor conductivity at various sites to identify problems that are occurring from OGD.
- Treatment facilities for streams impacted by acid deposition should be implemented in additional watersheds and monitored.
- Address sedimentation problems identified in Elk County on the following streams: Three Mile Run, Crooked Run, Steck Run and Little Otter Run. In addition, sedimentation was observed in the Hunter Creek watershed and the roads in this watershed should be reviewed.
- Mitigation of roads in the Grunder Run watershed is needed to reduce the sediment loads. The monitoring of sediment loads should continue at Grunder Run and Hedgehog Run as funding permits.

Soil

Soil disturbance

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Is detrimental soil disturbance exceeding regional thresholds?	Annual	5 years	A

Protocol – Soil disturbance and soil productivity loss in timber sales is monitored annually to show compliance with Regional soil disturbance guidelines. Boundaries, along with areas of major soil disturbance and areas of lowered productivity are recorded. Soil disturbance in this study refers to any area where soil has been detrimentally disturbed in any way (i.e., severe compaction, displacement, puddling, rutting, burned, eroded, or mass movement). The level of disturbance for each soil criteria (i.e., severe compaction, displacement, puddling, rutting, burned, eroded, or mass movement) to be detrimental is found in USDA-FS 2012.

Soil disturbance monitoring occurred in FY 2008 (two timber sale payment units), FY 2009 (16 randomly selected timber sale payment units), and FY 2010 (one timber sale payment unit). The payment units were checked on the ground for skid trails, landings, and other impacts, which could be

considered a form of detrimental disturbance to soils. All disturbed areas were inventoried using GPS and/or orthophotographs and the acreage of disturbance was recorded.

Results

See *Effects of management practices* for results from the FY 2008 (Forest Road 230 timber sale) and FY 2010 (Mud Lick and Chappel 2003 blowdown salvage sales) soil disturbance monitoring.

Over the 16 units (308 acres) monitored in FY 2009, all skid trails with compacted soils were measured and recorded. Skid trails averaged 0.9 acres of disturbance (Table 62) while log landings with compacted soils were measured and recorded with an average 0.5 acres of disturbance. The major disturbance factor in these units was compaction. Total detrimental soil disturbance averaged 8% of the activity area, well below the regional standard of 15%.

Table 62. Post-harvest soil monitoring of timber sale payment units (FY 2009)

Sale	Payment Unit	Unit Acres	Skid Trail (feet)	Skid Trail (acres)	Landing (acres)	Total Acres Disturbed	Percent Disturbance
Clarendon	2	2	1,000	0.3	0.1	0.38	19%
Fire-Tower	9	36	5,800	1.6	0.9	2.51	7%
Fire-Tower	8	36	5,000	1.4	0.9	2.29	6%
Fire-Tower	6	26	1,100	0.3	0.2	0.47	2%
Fire-Tower	10	10	1,300	0.4	0.5	0.81	8%
Fire-Tower	5	13	1,500	0.4	0.0	0.44	3%
Rock Run	3	13	3,800	1.0	0.9	1.96	15%
Rock Run	1	23	7,122	2.0	0.1	2.07	9%
Rock Run	5	12	3,200	0.9	0.0	0.90	8%
East Lewis	4	11	2,000	0.6	0.5	1.00	9%
East Lewis	5	10	1,100	0.3	0.5	0.75	8%
East Lewis	6	18	2,517	0.7	0.5	1.14	6%
Sheriff West	18	17	4,195	1.2	0.3	1.50	9%
Sheriff West	16	29	5,300	1.5	0.1	1.57	5%
Sheriff West	11	13	2,870	0.8	0.7	1.47	11%
Sheriff West	4	39	3,652	1.0	0.8	1.78	5%
Average		**19.25**		**0.9**	**0.5**		**8%**

Conclusions – The ANF has a goal to limit detrimental soil disturbance to 15% of an activity area. After a year of recovery after a timber sale, the only disturbance areas found are usually in skid trails and landings. Key detrimental soil conditions resulting from ground-based timber sale activities include detrimental compaction, detrimental puddling, severe rutting, and accelerated surface soil erosion, and detrimental displacement. One of the stands monitored exceeded the 15% disturbance goal. One

possible reason for why this stand exceeded the disturbance standard is most likely related to the small size of the unit – there were too many skid trails within this small two-acre payment unit.

The average percent disturbed of the 16 payment units was 8% detrimental soil disturbance, which is well below the goal of 15% disturbance. This is very similar to results we have found in previous years of disturbance monitoring (see *Effects of management practices* for results from the FY 2008 soil disturbance monitoring).

Although dedicated soil disturbance monitoring has not occurred on an annual basis, the ANF still conducts surveys before projects to avoid or mitigate sensitive areas on every stand where vegetation management is planned. These surveys identify soils with poor drainage, water resources (e.g., streams and wetlands), rocky areas, and steep slopes that should be avoided or require additional mitigations. Timber sale administrators work with harvesters to layout skid trails so that they minimize disturbance and impacts to resources.

Recommendations – Post-harvest soil monitoring should continue to ensure that the amount of disturbed areas is minimized to reduce the compaction of soils so that soils have the capacity to sustain herbaceous and woody plant growth. Soil monitoring should occur in stands on each District.

Wildlife, Fish, and Sensitive Plant Habitat

Bald eagle conservation measures

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Are bald eagle conservation measures being implemented? What management activities are occurring within suitable nesting, foraging and roosting habitat?	Annual	Annual	A/B

Background, Protocol, and Results – Two "sets" of bald eagle conservation measures were developed for the 2007 Forest Plan. The first "set" is included in Appendix C of the Forest Biological Assessment (BA) that was completed during Forest Plan revision and submitted to the USFWS. This set represents the ANF's Conservation Program for the bald eagle. There are six conservation measures included in the Conservation Program. The second "set" was issued by the USFWS in their concurrence letter as conservation measures to implement in order to reach a "not likely to adversely affect" determination (USDI-FWS 2007). There are 11 measures included in this second "set".

As stated in the *Approval and Declaration of Intent*, the Chief of the Forest Service affirmed the 2007 Forest Plan in February 2008, but suspended application of the new design criteria to OGD. As a result, the bald eagle conservation measures that would apply to private oil and gas are not applicable. The ANF may negotiate mitigation measures with operators consistent with the conservation measures and 2007 Forest Plan standards and guidelines; however, in compliance with the Chief's instructions, Notices to Proceed associated with outstanding and reserved mineral development are being evaluated under the 1986 Forest Plan standards and guidelines and the ANF uses the protocol discussed in the *Identify resource concerns associated with oil and gas development* section to avoid, mitigate, and resolve resource concerns associated with OGM development.

Conservation Program

1. Measure: The likelihood of bald eagle death or injury due to fishing-associated activities shall be reduced by the monthly cleanup of discarded fishing line and lures at developed fishing access sites on and near the Allegheny Reservoir.

   Protocol/Results: As Forest Service personnel and concessionaires that manage Forest Service boat launches come across fishing line and lures, they were collected and properly disposed of. In addition, there is an annual Allegheny River and Allegheny Reservoir cleanup. News releases were distributed to educate hunters and to inform landowners of the need to protect bald eagle nests, foraging, and roosting habitat.

2. Measure: Predator guards will be installed and maintained on bald eagle nest trees, in cooperation with PGC.

   Protocol/Results: The ANF worked with PGC when new predator guards needed to be installed or existing predator guards needed maintenance or replacement.

3. Measure: In cooperation with PGC, monitor known eagle nests and search for new ones. Provide monitoring data to PGC and USFWS, annually, at the end of each nesting season.

   Protocol/Results: Known nests are observed in the field each year to record occupancy and number of chicks fledged. Nests are checked often during mating season and less frequently when the chicks have hatched. Reports of new nests are field verified. Searches for new nests are occasionally conducted before leaf out in high potential nesting habitat. See *Maintain or increase productivity of bald eagles*. Results were shared with PGC and USFWS.

4. Measure: All reports of dead eagles on the ANF will be investigated by ANF or PGC personnel and reported to local PGC Conservation Officers and the USFWS.

   Protocol/Results: All reports of dead eagles found on or near the ANF were forwarded to the appropriate Regional PGC office.

5. Measure: Signs and/or news releases shall be displayed or distributed to educate hunters and to inform landowners of the need to protect bald eagle nests, foraging and roosting habitat.

   Protocol/Results: News releases were distributed to educate hunters and to inform landowners of the need to protect bald eagle nests, foraging, and roosting habitat.

6. Measure: In order to protect the bald eagle and maintain suitable habitat if it is de-listed, bald eagle management guidelines consistent with those identified in the Bald and Golden Eagle Protection Act (BGEPA) will be implemented upon de-listing.

   Protocol/Results: Conservation measures have been maintained since the bald eagle was delisted in July 2007.

Concurrence Letter

1. Measure: Around each nest, a 660-foot, no-disturbance buffer will be in place year-round. No activities that may disturb eagles or alter habitat (e.g., timber harvest, land clearing, OGD, road construction and maintenance, trail construction, habitat improvement) will be undertaken within this buffer. The buffer will remain in place for five years after a nest has been abandoned. A larger buffer will be implemented as necessary.

   Protocol/Results: Project-level documents and Plan of Operations Review (private OGD) were reviewed. No Forest Service activities that may have disturbed eagles or altered habitat were proposed or occurred within the year-round 660-foot buffer applied to active nests. The ANF did not need to negotiate mitigation measures with private oil and gas operations as no developments were proposed within the year-round 660-foot buffer. The 660-foot nest buffer was maintained where nests remained in active status (for five years after a nest was determined abandoned).

2. Measure: Recreational activities within 660 feet of active bald eagle nests will be avoided. The buffer will be established and maintained through the use of buoys, signs, road closures, or other appropriate measures when necessary. The Forest Service will establish a larger buffer when this is necessary to avoid adverse effects. If monitoring indicates a smaller buffer will result in no adverse effects, the Forest Service may establish a smaller buffer following consultation with the Fish and Wildlife Service.

   Protocol/Results: On-the-ground monitoring of recreational activities near actives nests was completed. The Cornplanter nest was vulnerable to boating and camping traffic. Signs were placed along the shoreline to warn people not to camp there. In FY 2013, this nesting pair successfully fledged two young. Since nesting began long before the boating season was in full swing, this pair of eagles seemed to tolerate the boat traffic.

3. Measure: From January 15 to July 31, the following activities will not take place within 1320 feet of bald eagle nests: road and trail construction and maintenance, timber-cutting and hauling, OGD, and low-level flights by Forest Service aircraft.

   Protocol/Results: Project-level documents and Plan of Operations Review (private OGD) were reviewed. No Forest Service activities occurred within the seasonal 1320-foot buffer applied to active nests. The ANF did not need to negotiate mitigation measures with private oil and gas operations as no developments were proposed within the seasonal 1320-foot buffer.

4. Measure: Local roads will be closed to public use where active nests are located on a case-by-case basis.

   Protocol/Results: On-the-ground monitoring of active nests was completed to indicate changes in eagle behavior. The non-system road near the Grove Run nest was closed; however, the nest tree blew over and this site was not active thereafter. The trail near the Kiasutha nest was closed in FY 2008 and has remained closed since then. The Kiasutha nest successfully fledged two young in FY 2013.

5. Measure: To maintain suitable roosting and nesting habitat, scattered white pines and other potential nest trees will be maintained along the slopes of the Allegheny Reservoir, Allegheny River, Tionesta Creek, Clarion River, Kinzua River, and Salmon Creek. Federal activities that may result in the degradation of habitat should be avoided within 300 feet of the Allegheny Reservoir, Allegheny River, and Tionesta Creek.

   Protocol/Results: On-the-ground observation as well as review of project-level documents and Plan of Operations (private OGD) was completed. White pine and other potential nest trees were maintained and no degradation of suitable roosting or nesting habitat occurred within 300 feet of the Allegheny Reservoir, Allegheny River, and Tionesta Creek.

6. Measure: A burn plan will be prepared prior to implementation of any prescribed burning, and any burning within primary bald eagle habitat will include smoke considerations or mitigation measures to reduce smoke-related impacts to bald eagle.

   Protocol/Results: A burn plan was completed for the fields near the Hall Barn. Smoke considerations were included to reduce potential impacts to the nearby eagle nest (Trunkeyville nest). The field was burned in FY 2008. A wildlife biologist monitored the Trunkeyville nest during the burn. No visible smoke reached the nest site and the eagles remained on the nest. No signs of stress to the eagles were observed.

7. Measure: If the bald eagle is removed from the federal list, existing standards and guidelines will remain in effect for five years, after which management guidelines identified in association with the BGEPA will be adopted.

   Protocol/Results: See the Protocol/Results for conservation measure 6 under the Conservation Program.

8. Measure: When non-federal activities, such as OGD, are proposed within 1320 feet of active bald eagle nests, the Forest Service will notify the developer of the presence of a federally listed species and the need to contact the USFWS. The Forest Service will concurrently notify the USFWS of the project.

   Protocol/Results: Plan of Operations (private OGD) were reviewed. No oil and gas activities were proposed within the 1320-foot buffer applied to active nests; therefore, the USFWS was not contacted.

9. Measure: Power lines will be installed in a manner consistent with the most current version of the Avian Protection Plan Guidelines, including submission of a site specific plan that will identify and reduce hazards to the bald eagle.

   Protocol/Results: Power line proposals and special use permits were reviewed. Two special use permits were issued for power lines; however, these permits were renewals for existing lines.

10. Measure: The Forest Service will continue to monitor bald eagle nest sites, nest productivity, and foraging and roosting areas on the ANF, and will report findings to the USFWS. Any potential impacts will be immediately eliminated with larger buffers in consultation with USFWS.

Protocol/Results: See the Protocol/Results for conservation measure 3 under the Conservation Program.

11. Measure: To reduce mortality, discarded fishing line and lures will be cleaned up monthly from May through September at developed fishing access sites around the Allegheny Reservior. Signs and news releases will be displayed and distributed to educate hunters not to shoot eagles, and inform landowners of the needs to protect bald eagle nests and habitat.

    Protocol/Results: See the Protocol/Results for conservation measures 1 and 5 under the Conservation Program.

Conclusions – Bald eagle conservation measures were implemented when applicable and management activities did not occur in suitable nesting, foraging, and roosting habitat within buffers established around active nests.

Despite wide-spread human activity associated with multiple resource management on the ANF, the integrity of active eagle nest sites is being maintained and reproduction is continuing at a steady rate (see *Maintain or increase productivity of bald eagles*).

Recommendations – Continue to monitor the implementation of eagle conservation measures.

Publish a news releases advising Forest visitors not to disturb eagles and asking them to pick up discarded fishing line.

Given it has been five years since the bald eagle was delisted, discuss with USFWS if and how management guidelines identified in the BGEPA differ from the conservation measures already implemented.

Indiana bat conservation measures

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Are conservation measures for the Indiana bat being implemented?	Annual	Annual	A/B

Background, Protocol, and Results – Two "sets" of Indiana bat conservation measures were developed for the 2007 Forest Plan. The first "set" is included in Appendix C of the Forest Biological Assessment (BA) that was completed during Forest Plan revision and submitted to the USFWS. This set represents the ANF's Conservation Program for the Indiana bat. There are six conservation measures included in the Conservation Program. The second "set" was issued by the USFWS in their concurrence letter (USDI-FWS 2007) as conservation measures to implement in order to reach a "not likely to adversely affect" determination. There are seven measures included in this second "set".

Conservation Program

1. Measure: Maintain bat interpretive display at Hall Barn and continue to provide bat educational opportunities to the public (public presentations and displays).

   Protocol/Results: The interpretive display at the Hall Barn was maintained and is now a geocache site where participants must read the interpretive panels and answer questions on bats to find the coordinates of the cache.

2. Measure: Maintain three bat condos at Hall Barn, Buzzard Swamp, and Camp Cornplanter. Erect additional bat condos and install additional bat boxes where needed. Maintain the Hall Barn and the baffles inside. Monitor bat use within these structures every two or three years.

   Protocol/Results: Condos at the Hall Barn, Buzzard Swamp, and Camp Cornplanter were maintained. Additional condos were constructed at the Bean Fields and Birdsell Edey. Also, in partnership with the National Wild Turkey Federation, bat boxes were installed across the Forest.

   Vegetation was removed annually from the sides of the Hall Barn and away from the foundation. The area around the barn and parking lot is also mowed annually as well as a path to the Hall Barn Condo. Vegetation is removed from the base of the condo and guano is periodically removed to prevent buildup. Boards were added as internal support to stabilize the front barn doors. The downspout was repaired and will be replaced in FY 2014. In addition to two new coats of paint, the Hall Barn louvers, trim, and roof will also be repaired and/or replaced in FY 2014.

   Annual emergence counts were conducted and results were shared with PGC as part of the *Appalachian Bat Count*.

3. Measure: Provide training opportunities to ANF biologists that include bat identification, biology, habitat requirements, and sampling techniques.

   Protocol/Results: As mist net surveys are not completed in-house, ANF staff did not receive training on these survey techniques; however, training opportunities were made available on acoustic sampling techniques (see the Protocol/Results for conservation measure 5 under the Conservation Program).

4. Measure: Complete 10 year snag longevity study started in FY 2000.

   Protocol/Results: Snag longevity plots were completed on the Marienville Ranger District. Half (five out of 10) snag longevity plots are complete on the Bradford Ranger District with the other half scheduled to be completed in the fall of 2014. Results will be summarized and shared with USFWS.

5. Measure: Between 20 and 30 bat survey mist net sites will be implemented once every third year to monitor bats on the ANF.

Protocol/Results: Mist net surveys were conducted at 31 sites in FY 2010 and 26 sites in FY 2013. No Indiana bats were captured.

Also, acoustic surveys were conducted from FY 2008 through FY 2013 along four driving routes to determine pre- and post- white-nose syndrome population trends. Results for FY 2010 through FY 2013 surveys were analyzed by the Eastern Region of the Forest Service's (Region 9) Acoustic Center for Excellence with automated acoustic bat ID software (EchoClass). The ANF is waiting on the USACE to similarly analyze results from the FY 2008 and FY 2009 surveys. Population trends will be reviewed when all results are available.

6. Measure: Coordinate with Pennsylvania Game Commission to conduct bat monitoring at caves on or in the vicinity of the ANF.

   Protocol/Results: There are no documented hibernacula on the ANF. PGC conducted hibernacula surveys at the only hibernacula within the ANF proclamation boundary on State Game Lands 29. Fall swarm surveys were conducted at one cave on the ANF during the fall of 2013. No Indiana bats were captured.

Concurrence Letter

1. Measure: In all timber harvest units:

   - One-quarter acre within each five acres of harvest should be set aside as reserve areas. Layout of reserve areas should emphasize the following: vernal ponds, wet depressions, unique plant communities, rock complexes, den trees, snags, conifers, mast producing species, and tree and shrub species that are a minor component of the stand. Additional live and dead trees scattered throughout the harvest unit should be retained.

   - Retain trees with characteristics of suitable roosts (dead or dying trees with flaking or exfoliating bark) whenever possible.

   - Retain all shagbark hickory.

   - Retain at least nine snags per acre greater than 10 inches dbh (where available).

   - Retain at least three live trees per acre ≥ 20 inches dbh (or largest trees available) of preferred roost tree species (e.g. hickories oaks, maples, elms, black locust, green and white ash). Where possible, these trees should be located in areas of the stand where thick regeneration that occurs after a final harvest will not shade or obstruct flight to the tree. Retain an additional 6 live trees per acre greater than 10 inches dbh.

   Protocol/Results: ANF marking guidelines require that one-quarter acre within each five acres of final harvest are set aside as reserve areas; trees with characteristics of suitable roosts are retained whenever possible; and all shagbark hickory are retained.

Marking tallies completed pre-harvest for final harvest units cut in FY 2008-2013 were reviewed for snag and live tree retention (Table 63). An average of 4.7 snags > 10 inches dbh per acre, 7.6 live trees > 10 inches dbh, and 2.0 live trees ≥ 20 inches dbh were retained in final harvest units.

Table 63. Final harvest unit marking tallies (FY 2008-2013)

Sale Name/Payment Unit #	Snags/Acre	Live ≥ 20" dbh/Acre	Live > 10" dbh/Acre
Conservation Measure Requirement	**9 Snags/Acre > 10" dbh**	**3 Live ≥ 20" dbh /Acre**	**6 Live > 10" dbh /Acre**
LMC Salvage Removals/1	7.0	Unknown*	8.6
LMC Salvage Removals/5	7.7	Unknown*	10.8
CHSP FR 237 Stewardship/1	7.4	Unknown*	7.4
CHSP FR 237 Stewardship/2	4.7	Unknown*	8.2
FR 473 Removals/1	5.1	Unknown*	10.2
Timberdoodle/7	4.3	Unknown*	4.0
Long Road/10	1.6	Unknown*	2.0
Turnup Run/9	6.4	Unknown*	7.0
Turnup Run/10	1.2	Unknown*	12.0
Reagan Run/2	0.5	Unknown*	9.0
Silver Slide IRTC/1	6.1	Unknown*	5.5
Silver Slide IRTC/3	7.6	Unknown*	20.0
Silver Slide IRTC/4	7.8	Unknown*	8.4
FR 150B Removals/1	7.2	Unknown*	7.5
FR 150B Removals/3	6.3	Unknown*	6.0
Phillips County Line/2	2.3	1.4	1.4
Phillips County Line/3	6.0	1.9	6.0
Elijah Run/5	3.4	0.7	3.2
Little Arnot/9	3.9	1.6	5.6
Mudlick/5	3.0	1.0	5.0
FR 744 Removal/1	8.7	Unknown*	6.0
FR 744 Removal/2	10.4	Unknown*	6.5
FR 340 Salvage Removal/1	6.0	Unknown*	11.3
FR 340 Salvage Removal/4	6.8	Unknown*	13.7
FR 340 Salvage Removal/8	5.3	Unknown*	11.6
Bobbs Fork/3	1.4	0.8	2.2
Bobbs Fork/6	2.2	1.2	4.3

Sale Name/Payment Unit #	Snags/Acre	Live ≥ 20" dbh/Acre	Live > 10" dbh/Acre
Conservation Measure Requirement	**9 Snags/Acre > 10" dbh**	**3 Live ≥ 20" dbh /Acre**	**6 Live > 10" dbh /Acre**
Bobbs Fork/8	3.7	0.7	4.3
West Sugar/1	3.4	6.7	8.7
West Sugar/7 & 8	5.7	7	18.0
Log Run/5	4.7	Unknown*	21.2
Brush Creek/12	5.1	Unknown*	8.4
Brush Creek/13	5.1	Unknown*	8.8
Mead/5	3.6	0.2	3.4
Mead/12	6.3	1.3	6.7
Slater Run/10	3.4	2	9.0
Slater Run/12	1.7	5	11.0
Mead/11	4.0	0.2	2.4
Indian Run/7	4.4	0.5	2.1
Hemlock Run/6	3.6	Unknown*	4.3
Hemlock Run/7	4.4	Unknown*	5.0
Sleeping Bear/1	2.7	Unknown*	5.7
Sleeping Bear/2	2.1	Unknown*	5.8
CHSP Little Seek Stewardship/1	4.7	0.5	6.7
CHSP Little Seek Stewardship/2	2.5	2.6	5.4
CHSP Kemp Run Stewardship/1	4.6	2.6	6.7
CHSP Kemp Run Stewardship/2	7.7	2.9	12.6
BHSP Iron Quad Stewardship/1	2.6	1.6	6.7
Average	4.7	2.0	7.6

*The diameter of live trees was not recorded. Trees recorded in the > 10" category may be ≥ 20" dbh.

See also *Standing and downed woody debris* for more on results on standing dead trees on the ANF.

2. Measure: For partial/intermediate harvests in healthy stands, retain canopy closure at optimal roosting and foraging habitat levels (> 50%).

   Protocol/Results: Marking checks completed pre-harvest for final harvest units cut in FY 2008-2013 were reviewed for residual relative density (Table 64; 43% residual relative density = 50% canopy closure). Residual relative density in partial harvest units averaged 57%, 45%, 59%, 49%, 46%, and 58% in, thinnings, shelterwood seed cuts, shelterwood preparation cuts, single

tree selection cuts, group selection cuts, and thinnings to accelerate mature forest conditions, respectively.

Table 64. Partial harvest (thinnings, shelterwood seed and preparation cuts, selection cuts, and thinnings to accelerate mature forest conditions) unit marking checks (FY 2008-2013)

Treatment	Average Residual Relative Density	Units	Units > 43% Residual Relative Density
Thinning	57%	36	33
Shelterwood Seed Cut	45%	41	20
Shelterwood Preparation Cut	59%	2	2
Single Tree Selection Cut	49%	4	4
Group Selection Cut	46%	1	1
Thinning to Accelerate Mature Forest Conditions	58%	2	2

3. Measure: All known roost trees on the ANF will be protected until they no longer serve as a roost. In the event that it becomes absolutely necessary to remove a known Indiana bat roost tree, removal will be conducted through consultation with USFWS, and during the time period when the bats are likely to be in hibernation (October 15 to March 31).

   Protocol/Results: No Indiana bat roost or maternity roost sites have been documented on the ANF.

4. Measure: During the review of OGD Plans of Operation, if known occurrences of federally-listed or candidate species are located in the vicinity of a proposed OGD, this will be documented in a letter to the operator and copied to the USFWS Field Office in State College, Pennsylvania. The letter will direct the operator to contact the Service to resolve issues related to threatened and endangered species prior to proceeding with any tree-cutting or earth disturbance.

   Protocol/Results: The Plan of Operations were reviewed and no Indiana bat occurrences were located within proposed OGD.

5. Measure: If Indiana bat maternity roost trees are discovered, protect the trees from physical disturbance and designate an area of use based on site conditions, radio-tracking or other survey information, and best available information regarding maternity colony needs. Maintain or enhance the site by maintaining an adequate number of snags, including known roost trees; maintaining large live tress to provide future roosting opportunities; and maintaining optimal roosting and foraging habitat.

   Protocol/Results: No Indiana bat roost or maternity roost sites have been documented on the ANF.

6. Measure: Conduct prescribed burning within any maternity colony only during the hibernating season.

Protocol/Results: No Indiana bat roost or maternity roost sites have been documented on the ANF.

7. Measure: Demolition or removal of buildings or other man-made structures that harbor bats should not occur between April15 and August 15. Bat boxes will be installed near the building prior to demolition. If the building must be removed when bats are present, a bat expert will survey the building to determine whether Indiana bats are present; if they are, consultation with USFWS will be necessary.

   Protocol/Results: No building containing bats were demolished.

Conclusions – When applicable, conservation measures were implemented with the exception of the snag retention and one of the live tree retention measures in final harvest units.

Only one of the final harvest payment units met the standard for retaining nine snags per acre greater than 10 inches dbh. It may be that these stands did not have a level of mortality that created an abundance of snags to retain; however, these tallies do not take into consideration the reserve areas left in units (at least one-quarter acre within each five acres of harvest), which retain additional snags as well as conifers and other unique features.

The first live tree guideline calling for the retention of three live trees per acre greater than or equal to 20 inches dbh was only met in three units. Each year this guideline will be easier to implement as the forest continues to mature. The second live tree guideline calls for the retention of six live trees per acre greater than 10 inches dbh was met in most units. Again, these tallies do not take into consideration the reserve areas left in units (at least one-quarter acre within each five acres of harvest), which retain additional snags as well as conifers and other unique features such as wildlife trees.

FIA data indicate that an abundance of standing dead trees of all sizes and stages of decay is present across the ANF, although individual stands may contain more or fewer snags than the averaged FIA sample. Standing dead trees in the least decayed classes indicate that snag recruitment is occurring. The higher volume of trees in the more advanced decay classes indicate that standing dead trees are persisting as snags for some time.

Recommendations – Continue to implement conservation measures with emphasis on retaining snags greater than 10 inches dbh and live trees greater than or equal to 20 inches dbh. Retaining trees that may become snags during the first entry (partial harvest) may result in more snags available for retention in the final harvest.

Complete snag longevity study.

Discuss with USFWS the overlap of existing conservation measures for Indiana bat and those recommended for the northern long-eared bat (*Myotis septentrionalis*; proposed for listing as endangered by USFWS).

Indiana bat status

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Does the Indiana bat occur on the ANF? What is the age, sex, and reproductive rate of bats captured? What is the estimated population?	Annual	3 years	A

Protocol – Conduct mist net surveys every third year on 20 – 30 sites across the ANF.

Results – The Indiana bat has not been documented on the ANF since 1998 or on adjacent private lands since 2001. Both captures were of adult males. Mist net surveys were conducted at 31 sites in FY 2010 and 26 sites in FY 2013. No Indiana bats were captured during these surveys.

Conclusions – The USFWS revised the Indiana bat range map for Pennsylvania in February 2014 (Figure 61) to reflect that the species is rare and likely transient on the ANF as documented through the ANF's intensive mist net survey efforts from FY 1998 through FY 2006 as well as in FY 2010 and FY 2013.

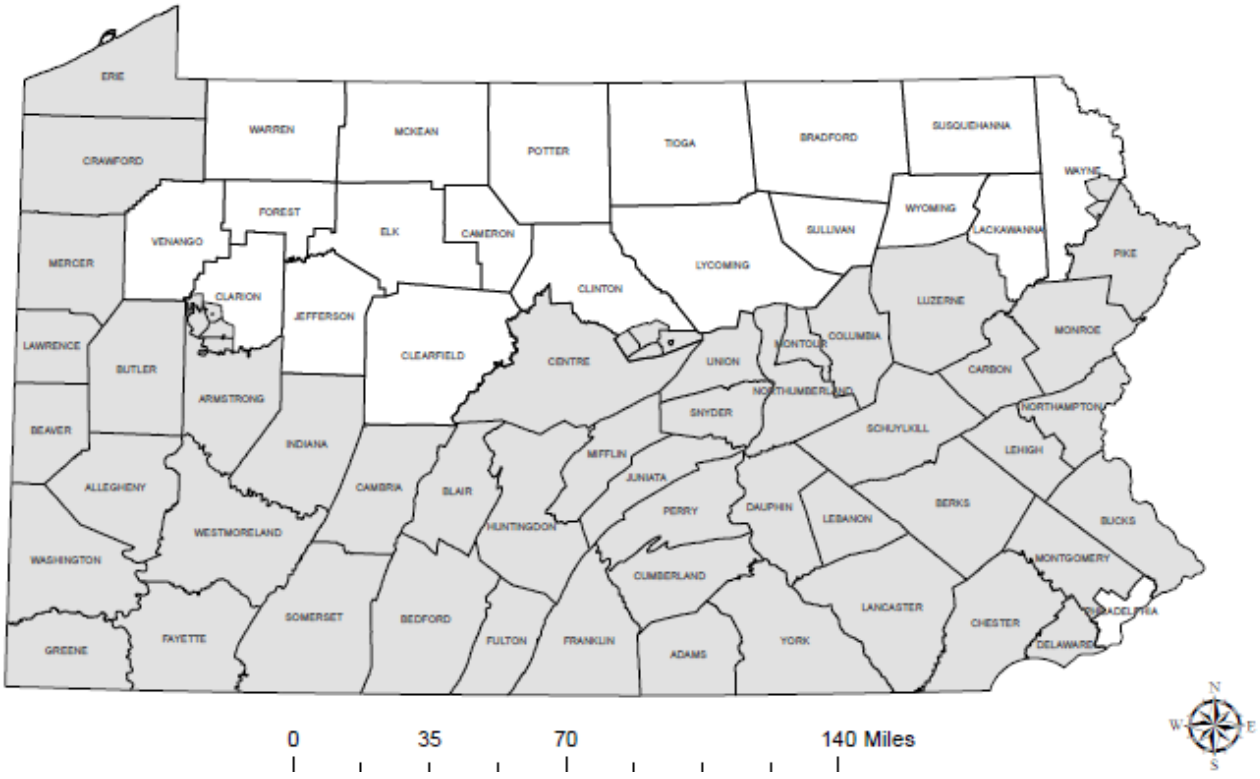

Figure 61. Counties in grey reflect Indiana bat range in Pennsylvania (February 2014; Turner pers. comm. 2014)

Recommendations – Continue mist net surveys every third year until otherwise coordinated with USFWS. Discuss with USFWS the implications of the revised Indiana bat range in Pennsylvania as

well as the overlap of existing conservation measures for Indiana bat and those recommended for the northern long-eared bat (proposed for listing as endangered by USFWS).

Clubshell and northern riffleshell conservation measures

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Are conservation measures for the clubshell and northern riffleshell mussels being implemented?	Annual	Annual	A/B

Background, Protocol, and Results – Two "sets" of mussel conservation measures were developed for the 2007 Forest Plan. The first "set" is included in Appendix C of the Forest Biological Assessment (BA) that was completed during Forest Plan revision and submitted to the USFWS. This set represents the ANF's Conservation Program for threatened and endangered freshwater mussels, including the clubshell (*Pleurobema clava*) and northern riffleshell (*Epioblasma torulosa rangiana*). There are seven conservation measures included in the Conservation Program. The second "set" was issued by the USFWS in their concurrence letter (USDI-FWS 2007) as conservation measures to implement in order to reach a "not likely to adversely affect" determination. There are 19 measures included in this second "set".

All these conservation measures pertain to activities within the 13% Area, which is the area of the ANF that drains directly into the Allegheny River. The protocols for the measures are varied and, likewise, the methods used to determine their implementation vary.

As stated in the *Approval and Declaration of Intent*, the Chief of the Forest Service affirmed the 2007 Forest Plan in February 2008, but suspended application of the new design criteria to OGD. As a result, the mussel conservation measures that would apply to private oil and gas are not applicable. The ANF may negotiate mitigation measures with operators consistent with the conservation measures and 2007 Forest Plan standards and guidelines; however, in compliance with the Chief's instructions, Notices to Proceed associated with outstanding and reserved mineral development are being evaluated under the 1986 Forest Plan standards and guidelines and the ANF uses the protocol discussed in the *Identify resource concerns associated with oil and gas development* section to avoid, mitigate, and resolve resource concerns associated with OGM development.

Conservation Program

1. Measure: Educational materials will be made available to the public about the threats that zebra mussels present, how they are transported, where they currently occur, and procedures to decontaminate watercraft. This material will be available as handouts, as well as signs posted at the marina and boat launches on the Allegheny Reservoir and at Buckaloons Recreation Area.

   Protocol/Results: Before the beginning of the boating season (Memorial Day weekend), educational materials are made available to various venues, such as concessionaires that manage campgrounds and boat launches, Forest Service offices, bait shops, and sporting goods stores, marinas, and visitor centers. Enough material is left for the public to take a personal copy. The materials are replenished during the boating season as needed. Larger signs posted at the marina and boat launches about the prohibition of launching watercraft that may contain zebra mussels

and the methods to be used to decontaminate a watercraft are inspected and replaced with new ones if needed.

2. Measure: Signs will be posted at the marina and boat launches on the Allegheny Reservoir, and at Buckaloons prohibiting the launching of vessels that may be carrying zebra mussels, unless such vessels have been decontaminated.

   Protocol/Results: See the Protocol/Results for conservation measure 1 under the Conservation Program.

3. Measure: At canoe access sites and the boat launch at Buckaloons, the Forest Service shall establish educational displays and/or provide educational materials explaining the same items listed in the first conservation measure above.

   Protocol/Results: See the Protocol/Results for conservation measure 1 under the Conservation Program.

4. Measure: The Forest Service will coordinate with other agencies in developing and implementing contingency plans and protocols for zebra mussel control and/or native mussel species protection in the event of zebra mussel incursion.

   Protocol/Results: A contingency plan has not been discussed or developed by other agencies as no zebra mussels have ever been documented in those portions of the Allegheny River adjacent to the ANF, according to the USGS Aquatic Invasive Species database and Pennsylvania Sea Grant who track such occurrences and are annually reviewed by ANF staff. Their website is not always up to date, so each year, except FY 2013, an email was sent with a response given that no new occurrences were documented in northwest Pennsylvania. However, during a 2009 dam removal on Conewango Creek in Warren, just upstream of the Allegheny River, several individual zebra mussels were collected and destroyed by PFBC. There were no clusters of zebra mussels found on the exposed substrate, only scattered occurrences.

5. Measure: The collection of dead, injured, or sick endangered mussels will be reported to USFWS.

   Protocol/Results: No dead, injured, or sick endangered mussels were documented.

6. Measure: Surveying the Allegheny Reservoir shoreline for ¼ mile on each side of ANF boat launches for the presence of zebra mussels, occurring after the reservoir has been drawn down at least 10-15 feet when possible. Zebra mussel detection surveys will be conducted along the shoreline for ¼ mile on each side of Forest Service developed boat launches within the Allegheny Reservoir (approximate pool elevation 1318 – 1313 feet or less (mean sea level)) conditions permitting.

   Protocol/Results: There were no reported occurrences. Substrate samplers placed on three docks (Wolf Run Marina, USACE dock at Kinzua Dam, Onoville Marina in New York) by the USACE did not harbor any mussels when retrieved near the end of the 2008 through 2012 recreational seasons. Samplers were not deployed in 2013.

   Also see *Prevent introduction of zebra mussels*.

7. Measure: Survey potential sources of water pollution from activities that may be occurring or will occur on the ANF. This includes assessing specific projects or types of projects, monitor water quality of tributaries to the Allegheny River, and remediate suspected causes of sedimentation through implementation of the terms and conditions below.

    - Existing trails shall be visually surveyed to determine which trails or trail segments are contributing sediment to perennial or intermittent streams. Appropriate erosion and sedimentation controls shall be implemented to correct identified problem areas.
    - Existing roads shall be visually surveyed to determine which roads or road segments are contributing sediment to perennial or intermittent streams.
    - Appropriate erosion and sedimentation controls shall be implemented to correct identified problem areas.
    - Tree harvesting/removal techniques shall continue to be visually monitored to ensure that standards and guidelines are in fact implemented and do in fact result in only insignificant amounts of transported sediment compared to areas where no earth disturbance takes place.
    - OGD activities (including individual Pollution Prevention and Spill Response Plans) shall continue to be visually monitored to ensure that guidelines for federally-owned leases are adhered to, and guidelines for privately-owned rights are adhered to. Appropriate action (e.g., reporting known or suspected violations to the EPA and/or PADEP) will be taken when guidelines are not followed.
    - The Forest Service shall periodically visually monitor private OGD (abandoned and active) on the ANF to determine whether or not pollutants (e.g., oil, gas, brine, sediment, etc.) are being properly contained to avoid contamination of the soil, water, or air. If any contamination is detected, suspected, or likely to occur, the Forest Service shall work with the developer who will remediate the situation; and/or report the incident to the appropriate federal and state authorities (i.e., EPA, PADEP). Any known or suspected take of federally listed species resulting from such activities shall be immediately reported to the USFWS.
    - Water quality monitoring stations (i.e., locations) shall be established on several tributaries to the Allegheny River immediately before those tributaries empty into the Allegheny River, with emphasis on determining sediment budgets for watersheds with varying degree of activities. The design of the study and placement of the stations should be coordinated with the USFWS. A depth-integrated sampler will be used to collect water samples that will then be sent to a lab for analysis.

    Protocol/Results: Visual monitoring of projects is conducted by Forest personnel, such as engineers, trail managers, oil and gas administrators, biologists, and soil and water resource personnel, during their normal work in the field and with scheduled visits to areas where the potential for water quality concerns could occur. A field visit or a discussion with the Contracting Officer Representative upon completion of any road or trail surfacing work is done to determine if the work meets the surfacing guidelines that have been prescribed to address runoff concerns. ANF staff inspect the preparation, drilling, operation, and plugging of OGD to identify unmitigated concerns. Water quality monitoring is accomplished by Forest personnel as water samples are generally collected during runoff events in order to assess the amount of fine sediment being transported by the streams. Two streams, Hedgehog Run and Grunder Run, were monitored. See *Status of water quality – US Geological Survey*.

In FY 2010, 0.14 mile of FR 245, 0.52 mile of FR 245C, and 0.02 mile of FR 524 were surfaced with DSA limestone. In FY 2012, 0.2 mile of FR 362 and 0.4 mile of FY 362B were surfaced with DSA limestone. In addition, a long section consisting of several miles of FR 160 was surfaced with DSA limestone as part of the Upper Reservoir relining project by FirstEnergy.

In the Grunder Run watershed, two stream crossings and adjoining roads were decommissioned reducing the sediment input to a tributary to Grunder Run. In all, 13 sections of private oil and gas roads totaling 5,007 feet were decommissioned preventing further sedimentation. Also in the Grunder Run watershed, one stream crossing was corrected by replacing the existing pipes with a correctly sized pipe that allowed the passage of fish. The approaches to the crossing were also surfaced with limestone to reduce sedimentation (this section of road is also part of the Rocky Gap ATV trail). Also, in the watershed located to the east of Grunder Run, Ott Run had work completed to address sedimentation. This included the removal of a stream crossing that consisted of three culverts. Three-hundred feet of road was also decommissioned that had been contributing runoff to the stream at this same crossing

For timber harvesting within the 13% Area, one stand originally harvested as a shelterwood seed cut in 1997 had a final harvest done in FY 2008 as part of the Stonehill Removal, thus completing the prescription for this stand. This unit was located high on the plateau with no water concerns. The Little Hammer timber sale, located partially in the 13% Area, had two units harvested; however payment units 03A and 05 were both outside the 13% Area. There was no active harvesting by the ANF in FY 2009 or FY 2010. In FY 2011, there was one active timber sale. This sale, Grunder East, had two payment units (8 and 9) harvested totaling 32 acres. In FY 2012 and FY 2013, there were four active timber sales. The sales included Grunder East, Grunder West, and Sill Run (all part of the Meads Mill project area) as well as a fourth active sale part of the Beaver Run Stewardship project. Review of LiDAR stream data prompted monitoring of one payment unit (14) within the Sill Run sale. A field review by the Forest Silviculturist and Forest Fisheries Biologist found no stream present and thus buffers were not required.

From FY 2008 through FY 2013, the review of well packages issued a Notice To Proceed were completed as possible based on available resources by ANF oil and gas administrators, the Forest Fisheries Biologist, and biological technicians (Table 65).

Table 65. Private OGDs reviewed in the 13% Area for water resource concerns (FY 2008-2013)

Case #	Date Reviewed	Roads Built	Well Sites Reviewed	Observations Made
209	8-21-2009	yes		Sill Run road crossing installed with 45"x35" culvert and 50-year flow should be 58"x36". Road surface has larger commercial stone, but still lot of fines. Approximately 900' of runoff reaching Sill Run.
277	8-21-2009	yes	pipeline	Significant erosion and runoff occurring from a pipeline constructed across several springs and an unnamed tributary to Grunder Run. There were no temporary or permanent erosion

Case #	Date Reviewed	Roads Built	Well Sites Reviewed	Observations Made
				control measures in place to help stabilize the site. After the review, the developer was notified by an ANF oil and gas administrator of the concern.
276	5-3-2010	in progress	0	At time of visit, lots of initial development activity occurring. Did not review on this day, but will need monitored.
277	5-3-2010	yes	pipeline	This was a follow-up review from 8-21-2009. Some waterbars put in on west side of unnamed tributary to Grunder Run, but some runoff still reaching stream. No waterbars on east side of stream where runoff is reaching stream in a couple locations. Lots of springs intercepted by the pipeline on the east side (as well as the west side)
B-002	5-5-2010	yes	11	Wells are upslope of any water resources. Noted commercial stone on roads. Drill cuttings sprayed on cutslope at well 470-14.
B-003	5-4-2010	yes	4	Road built into wells 111 and 112 looked good except that two 6" casings used for minor crossings between well 111 and 112 were significantly undersized and do not meet any BMP or road standard. Cutslopes well-seeded. Well pad 112 up against a stream and should be monitored regularly. A pile of drill cuttings in the woods was discovered adjacent to well site 126. This material has the potential to move off-site and into a nearby tributary to Browns Run.
B-004	5-4-2010	yes	6	No concerns with runoff and water resources.
B-006	5-3-2010	to 2 wells	2	Road leading to wells 24 and 25 in very bad shape. Road is downcutting from runoff. May reach a drainage that leads to Dale Run, but did not walk it out to check. Wells 22 and 23 weren't drilled at time of visit, but road leading to wells will need careful placement of culverts to avoid impacting springs located just downslope.
B-012	5-3-2010	yes	1	This is a deep well. No concerns. Located high on the plateau.
B-019	5-4-2010	NTP not issued at the time of review		Layout and marking of timber done. Will need to insure runoff is not directed

Case #	Date Reviewed	Roads Built	Well Sites Reviewed	Observations Made
				to existing springs and live drainages.
B-020	5-4-2010	NTP not issued at the time of review		No work had begun
B-037	5-2010	to 8 wells	0	No water related concerns with roads built to wells 19-22 and 26-29. Road layout done for wells 23-25 and 30-32; lots of potential water resource concerns that need followed up, including many springs and wetlands.
B-050	5-7-2010 and 5-12-2010	cleared only	15, although not drilled since wells not permitted yet	Serious erosion and runoff into the Sill Run drainage was occurring throughout the development, where little to no erosion and sediment control measures were in place. Numerous small streams and springs were heavily laden with sediment.
B-052	5-6-2010	cleared only	6, although not drilled on day of review	All wells high and dry, so no water concerns. However, within the lease, ATV trails are established going straight up and down the slopes below this well package.
B-054	5-5-2010	yes	9; 1 was in progress	Roads built well. Most cutslopes seeded and sloped nicely; some reseeding needed. Drilling pits piled high against some trees which may lead to damage. Big pile of drill cuttings on cutslope at well 470-18. Potential runoff to Morrison Run that needs additional monitoring. Road leading to an old well to be plugged had significant runoff to ditch along FR156 and then to Morrison Run.
B-086	5-7-2010	cleared only	0	Did not review well sites. Appear to be upslope of any water resource. A follow-up should be conducted.
B-020	1-24-2011	yes	4	Wells 5, 6, 7, 8, and tank battery 100% complete; all Inspection Items are 'Satisfactory'
B-019	4-15-2011	yes	7	Road templates need to be reworked to permit the water to run off instead of running down the 2-track. Pipelines that were dug across the roadway have settled considerably and need to be filled in. Follow-up inspection planned within the next 14 days.
B-006	7-7-2011	to 2 wells	2	Road leading to wells 24 and 25 still in very bad shape as was the case during the 2010 visit. Road is downcutting from runoff. Two plastic crossdrains

Case #	Date Reviewed	Roads Built	Well Sites Reviewed	Observations Made
				are collapsed and likely not functioning properly. The site does not look very active. Wells 22 and 23 still not drilled at time of visit, but existing woods road leading to wells will need careful placement of culverts to avoid impacting springs located just downslope. There is a corrugated plastic pipe under road entrance (before gate) that leads to a tributary to Dale Run. This pipe drains the ditchline. It is highly likely that runoff from the entrance is also reaching the outlet end which then connects to the tributary. Roads need work and gate kept closed.
B-151	7-27-2011	NTP not issued at the time of review		Layout of wells and flagging of roads complete
277	8-30-2011	yes	pipeline	This was a follow-up review from 2009 and 2010 of a pipeline that crosses a tributary to Grunder Run. The waterbars put in on west side of unnamed tributary are working properly, and the pipeline is very well vegetated. No further concerns at this point. On east side of crossing, the pipeline is now very well vegetated, but no waterbars to disrupt water that is flowing down well-defined scoured channels. Need several waterbars on the east side of crossing as this section is steep and lengthy and captures numerous springs and runoff during rain events.
B-019	9-9-2011	yes	7 (3 drilled)	No water resource concerns with two of the drilled wells (40-8 and 40-9) or roads. Doesn't appear there will be any concerns with roads built to other wells, except for 40-11. Well 40-11 is drilled and road built beyond well 40-6 (from a previous well package). This road crosses a small

Case #	Date Reviewed	Roads Built	Well Sites Reviewed	Observations Made
				drainage (located between FR160D and well 40-6) and is contributing excessive runoff. This needs corrected. No runoff concerns at the well pad for 40-11, but will need to monitor runoff as it works its way around the backside of the well pad in the coming years. There is heavy runoff at the intersection of the road leading to wells 40-6 and 40-11, and FR160D. Need better water control; road is downcutting.
B-020	9-9-2011	yes	4	No water resource concerns. High and dry.
B-149	6-25-2012	yes	2	Well 24: well established drainage flows along west side of well pad as close as 25'. Well pad appears slightly sloped away from stream; grass coming in nicely. Need to monitor. Well 25: new road within approximately 40' of stream at the closest, near the road entrance; filter strip should be OK. Disturbed soils well seeded; grass coming in nicely. Nice runoff control at culvert inlet on FR 323 at the entrance to the OGD road. Need to monitor. The LiDAR stream originates just north of well pad 24 at an existing OGD road. The culvert on this older road is ~90% plugged and needs corrected. At the end of this road is an illegal ATV trail, most likely OGD; heavy damage to soils; steep. The culvert on FR 323 at entrance road to well 25 is now too short (18"x~18') and is rusted (C condition). Sediment from road overtopping outlet. Stream is heavily laden with sediment. Would recommend either decommissioning this short section of FR 323 from well 25 to the private line, or replacing existing culvert with longer one.
B-151	6-25-2012	yes	7	Looked at well sites 15-21. Wells drilled but not fracked. No pump jacks yet. All high and dry. No water

Case #	Date Reviewed	Roads Built	Well Sites Reviewed	Observations Made
				concerns. Very low priority to monitor.
B-149	4-4-2013	yes	2	Minor rutting of Forest Service road, will monitor during spring break-up; all Inspection Items are 'Satisfactory'
B-52	7-18-2013	yes	6	Small amount of stripped material remaining against boundary trees at wells 2 and 4; all other work completed as required. ATVs are no longer running the pipelines as these have been adequately blocked with boulders. Vegetation is catching nicely and is about 90% overall. Scarification completed as requested. All Inspection Items are 'Satisfactory'
B-050	1-13-2014	yes	9 wells in production; 13 remain undrilled	Ditches appear stable with varying amounts of vegetation present; all Inspection Items are 'Satisfactory'

In FY 2008, the primary issue observed by oil and gas administrators was the lack of maintenance of silt fences. Sediment from roads was also identified as a concern on some private OGD within the 13% Area. Several locations were contributing sediment to nearby streams. The ANF coordinated with the operators and regulatory agencies (e.g., PADEP) to remedy identified concerns.

No cases were noted where oil, gas, or brine were being improperly stored; however, some containment pits appeared too small to capture the fluids from the largest tank at a tank battery should it drain completely.

For results of the Hedgehog Run and Grunder Run monitoring, see *Status of water quality – US Geological Survey*.

Concurrence Letter

1. Measure: During project-level planning and implementation, riparian corridors will be defined on the basis of soils, vegetation, and hydrology (surface and groundwater) that will maintain the ecological functions and values associated with the riparian area. Riparian corridors will vary by water feature, but at a minimum will be defined by the fixed width distances in the Forest Plan (USDA-FS 2007a, p. 75). Within the defined riparian corridors identified in the Forest Plan:

    - Construction of new facilities, roads, motorized trails, OGD, landings, and buildings will be avoided.
    - Streams, wetlands, and their riparian corridors will be kept free of logging debris, sawdust, equipment, oil, and other materials or obstructions.

- Cable yarding that crosses streams should avoid impacts to the stream channel. Crossings should be at a right angle, with full suspension.
- When management activities occur, special attention will be given to riparian dependent resources.
- In riparian corridors within the 13% area, herbicides will only be used for management activities necessary to control invasive exotic plant species.
- In riparian corridors within the 13% area, timber harvesting should not occur.

Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

2. Measure: Proposed management activities shall be planned, evaluated, and implemented consistent with measures developed to protect the clubshell and northern riffleshell including those recognized to maintain, improve, or enhance their habitat. These measures include, but are not limited to, implementing standards and guidelines in the Forest Plan.

   Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

3. Measure: Maintain watershed health and water quality by following guidelines contained in the current versions of Timber Harvest Operations Field Guide for Waterways, Wetlands, and Erosion Control, and Erosion and Sediment Pollution Control Program Manual, PADEP.

   Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

4. Measure: Woody material naturally occurring in streams should only be removed when fisheries habitat is being degraded or when damage is likely to infrastructure such as bridges and culverts or private property. When a river is impassable due to woody debris, remove only the portion necessary for safe passage of boats; the need will be determined on a case-by-case basis.

   Protocol/Results: Wood removal from streams is only done according to the guideline in the Forest Plan and is assessed through discussion with engineers on the Forest on whether this action occurred. No specific incident of wood removal was noted.

5. Measure: Firewood should not be collected from streams, wetlands, springs, seeps, and vernal ponds.

   Protocol/Results: Firewood permits include terms prohibiting the taking of firewood from streams. People cutting firewood are periodically checked by Forest personnel to ensure they are in compliance with language in the permit. No specific incident of wood removal was noted.

6. Measure: The drafting of water from a stream should maintain existing uses such as fish and aquatic life, including threatened and endangered species and their habitat.

   Protocol/Results: The drafting of water is not monitored continuously, but when Forest personnel see a concern with maintaining existing uses, PADEP will be notified. No concerns with maintaining existing uses were identified by Forest Service personnel.

7. Measure: Glyphosate shall not be applied to surface waters or within 10 feet of standing or flowing water. This buffer should be adjusted based on field conditions at the time of spraying, in order to account for moister or drier conditions.

   Protocol/Results: See *Effectiveness of herbicide design criteria*.

8. Measure: Any roads constructed or reconstructed within 300 feet of a stream, as well as existing roads located within 300 feet of a stream, shall use a high quality surfacing material to minimize sediment delivery. In the event that this cannot be achieved, the USFWS will be consulted.

   Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

9. Measure: Any motorized trails constructed or reconstructed within 300 feet of a stream, as well as existing motorized trails located within 300 feet of a stream, shall use a high quality surfacing material to minimize sediment delivery. In the event that this cannot be achieved, the USFWS will be consulted.

   Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

10. Measure: Permanent and temporary road and trail crossings of streams shall be limited, and will be designed to minimize erosion. A high quality, non-erosive surfacing material, binding material, or other suitable material or methods should be used to control sediment delivery where vegetative cover is either inappropriate or expected to be inadequate for effective erosion control. Pit run sandstone is only appropriate for stream crossings as a subgrade material.

    Protocol/Results: No new Forest Service road or trail crossings (permanent or temporary) were constructed.

    See also the Protocol/Results for conservation measure 7 under the Conservation Program and conservation measure 18 under the Concurrence Letter.

11. Measure: Where natural revegetation is unlikely, or sedimentation and erosion are concerns, plant native or desirable non-native species immediately after road or trail construction or reconstruction.

    Protocol/Results: See the Protocol/Results for conservation measure 10 under the Conservation Program.

12. Measure: Where stream crossings are needed, bridges and bottomless arches should be favored rather than culverts and should be utilized to maintain fish and aquatic passage, stream channel structure, erosion control, bank stability, and stream gradient. Structures that properly distribute flood flow, bankfull flow, and sediment transport capacity should be used.

    Protocol/Results: In FY 2013, Otter Resources installed a new crossing on lower, mainstem Ott Run. That same year, PADOT replaced an existing crossing on Morrison Run. In both instances, the culvert was set too high in the channel and each crossing is now at least a partial aquatic organism barrier. The ANF is working with both parties to correct the situation.

See also the Protocol/Results for conservation measure 10 under the Conservation Program.

13. Measure: Permanent stream crossing structures should be designed and constructed to withstand a minimum of 50-year storm event and should not constrict the channel width.

    Protocol/Results: See the Protocol/Results for conservation measure 10 under the Conservation Program.

14. Measure: Temporary stream crossings should be constructed to accommodate a minimum of bankfull flow.

    Protocol/Results: See the Protocol/Results for conservation measure 10 under the Conservation Program.

15. Measure: Roads constructed for OGD shall meet Forest Service standards for local roads.

    Protocol/Results: The ANF may negotiate mitigation measures with operators consistent with the conservation measures and 2007 Forest Plan standards and guidelines;

    The number of wells permitted within the 13% Area from FY 2008 through FY 2013 is summarized in Table 66, and road construction is associated with each well package (0.1 mile of road construction per well; USDA-FS 2010).

    Table 66. Private oil and gas proposals in the 13% Area issued a Notice To Proceed (FY 2008-2013)

Fiscal Year	Notices To Proceed Issued	PADEP Permitted Wells
2008	7	70 (including 1 deep well)
2009	5	58
2010	11	71 (including 1 test well)
2011	13	145
2012	4	45 (including 1 Marcellus)
2013	15	75, 3 stone pits, and 1 road

16. Measure: During the review of OGD Plans of Operation, if known occurrences of federally-listed or candidate species are located in the vicinity of a proposed OGD, this will be documented in a letter to the operator and copied to the USFWS Field Office in State College, Pennsylvania. The letter will direct the operator to contact the Service to resolve issues related to threatened and endangered species prior to proceeding with any tree-cutting or earth disturbance.

    Protocol/Results: There were no instances where a known federally listed species was located within an area of a proposed OGD, and thus notification to the USFWS was not required.

17. Measure: Oil and gas operators will implement and maintain their submitted Soil Erosion and Sedimentation Control Plan and Spill Prevention Plan.

    Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

18. Measure: Monitor or survey potential sources of water pollution, including trails, roads, timber harvests, and OGD, to ensure 1) standards and guidelines are implemented, 2) only minimal sediment is produced from these activities, and 3) appropriate erosion and sedimentation controls are implemented to correct any identified problems.

    Protocol/Results: See the Protocol/Results for conservation measure 7 under the Conservation Program.

19. Measure: Conservation measures specific to the Wild and Scenic River Corridor (MA 8.1) include the following:

    - Timber harvest associated with forest management will be limited to address recreation and scenery management activities, user safety, wildlife concerns, forest health, or catastrophic events. Vegetation management is infrequent and may take place to 1) improve habitat for species of concern, restore ecosystems, or maintain existing unique or important wildlife features or plant communities; 2) maintain or expand of existing facilities or trails; 3) carry out conservation, research, or education around heritage sites; and 4) conduct timber salvage and associated reforestation.
    - Existing roads or aerial harvest methods will be used for salvage harvests.
    - Roads will not be constructed on islands and will be limited to those needed for public access, or service and maintenance. New road construction will be limited to that required for designated special uses or by law to provide access to non-federal land or valid existing mineral rights
    - Mitigate or decommission roads that are causing environmental damage, degrading outstandingly remarkable values, or to manage visitor use and access.

    Protocol/Results: An evaluation by a Forest Biologist will be made of any proposed activities within the Wild and Scenic River corridor to insure they comply with this measure. None of the activities were proposed.

Conclusions – When applicable, conservation measures were implemented with the exception of herbicide buffers in the 13% Area. Requirements for larger buffer widths within areas that fall within the 13% Area were overlooked by District staff and did not meet Forest Plan guidelines for protection of northern riffleshell and clubshell mussels; however, all but one of these areas had sufficiently sized buffers that were consistent with standards for protection of water quality in general forest areas during herbicide application, so no effect to mussels is predicted.

As a result of this monitoring, the Forest Silviculturist and Forest Fisheries Biologist followed up with District staff and contract administrators to reiterate special guidelines relative to herbicide application within the 13% Area. Additionally, a comprehensive table comparing vegetation management, equipment, and herbicide limitations within wetland management zones and riparian corridors within the 13% Area and the remainder of the ANF was developed early in FY 2012 and distributed to ANF silviculture, timber layout and marking, and herbicide contract administration staff. This table consolidates related Forest Plan standard and guideline information from the different sections: 2150 (Environmental Management), 2500 (Watershed and Air) and 2600 (Wildlife, Fish and Sensitive Plant Habitat).

Recommendations – The Forest should improve its current system of tracking the status of OGD in the 13% Area after a Notice To Proceed is issued.

Sediment load and yield monitoring should resume in Grunder Run and Hedgehog Run.

Discuss with USFWS:

- The slight increase in zebra mussel introduction risk;
- That the conservation measures that would apply to private oil and gas are not applicable; and
- The listing of the rayed bean (*Villosa fabalis*; endangered), sheepnose (*Plethobasus cyphyus*; endangered), snuffbox (*Epioblasma triquetra*; endangered), and rabbitsfoot (*Quadrula cylindrica cylindrical*; threatened) as they are either documented within the proclamation boundary of the ANF or have suitable habitat present. The ANF consulted on the rayed bean and sheepnose when they were listed as candidate species. ANF specialists have also considered the snuffbox and rabbitsfoot in the context of the conservation measures the ANF already applies for the clubshell and northern riffleshell. The four recently listed species have sensitivities and distributions similar to the clubshell and northern riffleshell, but additional discussion with USFWS is necessary given these species' elevated protection status.

High quality remote, interior, and late structural/old growth habitat

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
What is the amount and distribution of high quality remote and interior habitat across the landscape? How much late structural/old growth habitat is provided?	5 years	5 years	B

Protocol – Apply the criteria developed for the Forest-wide Roads Analysis Report (USDA-FS 2003) and Forest Plan FEIS (USDA-FS 2007b, p. 3-137) to identify high quality remote habitat (a subset of unroaded areas – quality remote habitat – greater than 500 acres in size with high wildlife value based on six wildlife criteria), late structural habitat (111-300 years old), and old-growth habitat (301+ years old) to current ANF GIS and the FS Veg database.

Results – There are 29 quality remote habitat areas (28,191 acres) and eight high quality remote habitat areas (33,006 acres) across the landscape (Table 67, Figure 62). Late structural habitat and old-growth habitat are found on 53,215 acres (10.5%) and 2,817 acres (0.6%) of the ANF, respectively.

Table 67. High quality remote habitat areas, late structural habitat, and old-growth habitat on the ANF

Habitat	Acres	Percent of ANF
High Quality Remote Habitat (8 areas)	33,006	6.5%
Late Structural (111 – 300 years old)	53,215	10.5%
Old-growth (301+ years old)	2,817	0.6%

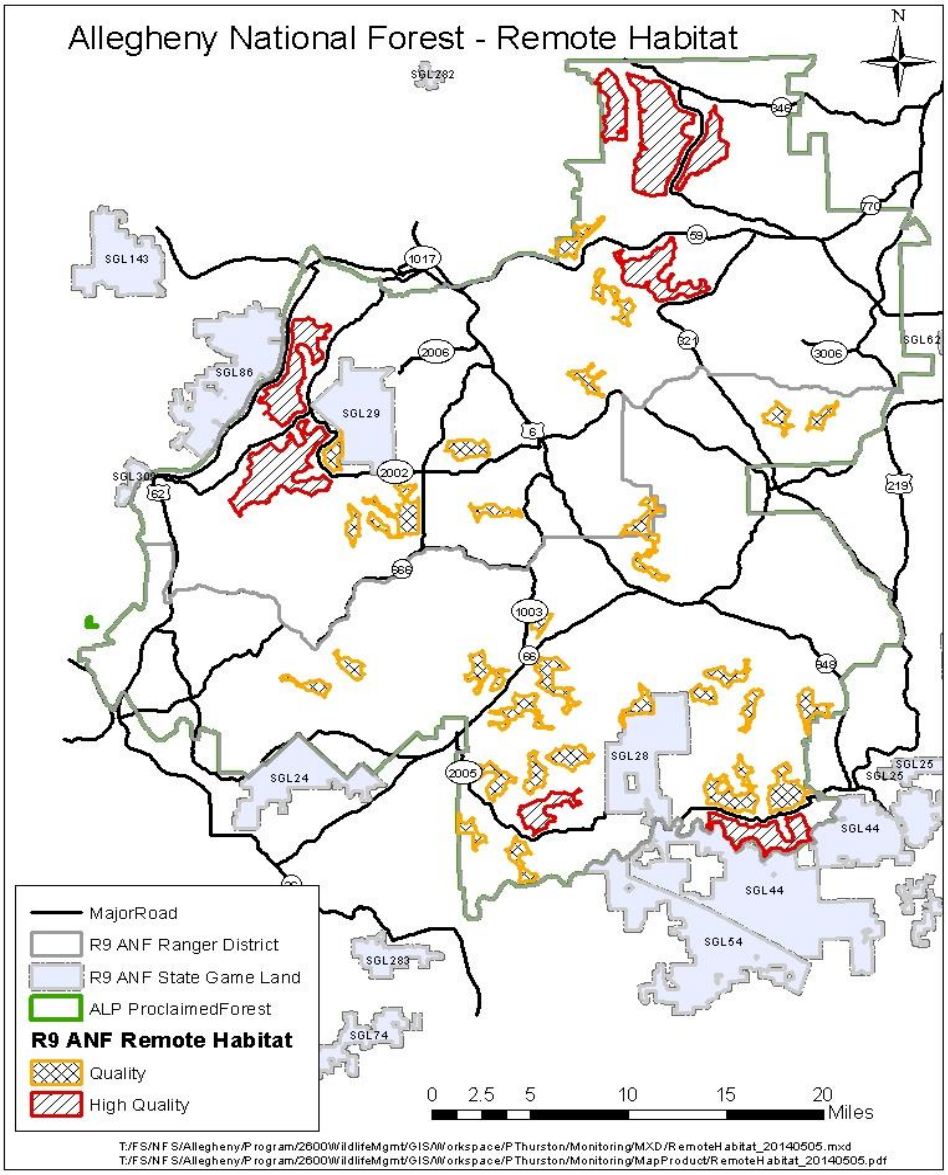

Figure 62. Distribution of quality remote habitat areas and high quality remote habitat areas on the ANF

Conclusions – The Forest-wide Roads Analysis identified 37 unroaded areas greater than 500 acres. All 37 areas were evaluated for six wildlife criteria, resulting in eight areas (33,006 acres) with a wildlife index of 26 or greater (USDA-FS 2003). The acreage and number of high quality remote habitat areas has been maintained since the start of 2007 Forest Plan implementation.

Late structural habitat and old-growth habitat comprised 3% (11,700 acres) and < 1% (3,300) of the ANF in 2006 (USDA-FS 2007b, p. 3-139). Late structural habitat has increased and old-growth habitat has decreased since the start of Forest Plan implementation.

Recommendations – Continue to analyze habitat fragmentation affects within project areas and reduce affects by strategically placing activities to maximize travel corridors and sustain quality remote habitat areas.

Standing and downed woody debris

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
What is the level of standing and downed woody debris across the landscape?	5 years	5 years	A/B

Protocol – Standing and downed woody debris on the ANF was evaluated using inventory data in the FIA database (Morin pers. comm. 2014).

Results

Standing dead trees

The vast majority of standing dead trees (snags) on the ANF are less than 19 inches in diameter (Figure 63). There are some standing dead trees larger than 20 inches in diameter, but these are in the more advanced stages of decay. Overall, there is an abundance of standing dead trees in all decay classes and in all diameter classes, but they are most abundant between 9 and 19 inches in diameter. The volume of standing dead trees that have recently died, with all limbs and branches present, is smaller than the volume of standing trees in the more advanced decayed classes, indicating that many trees remain standing and serve as snags for some time following death.

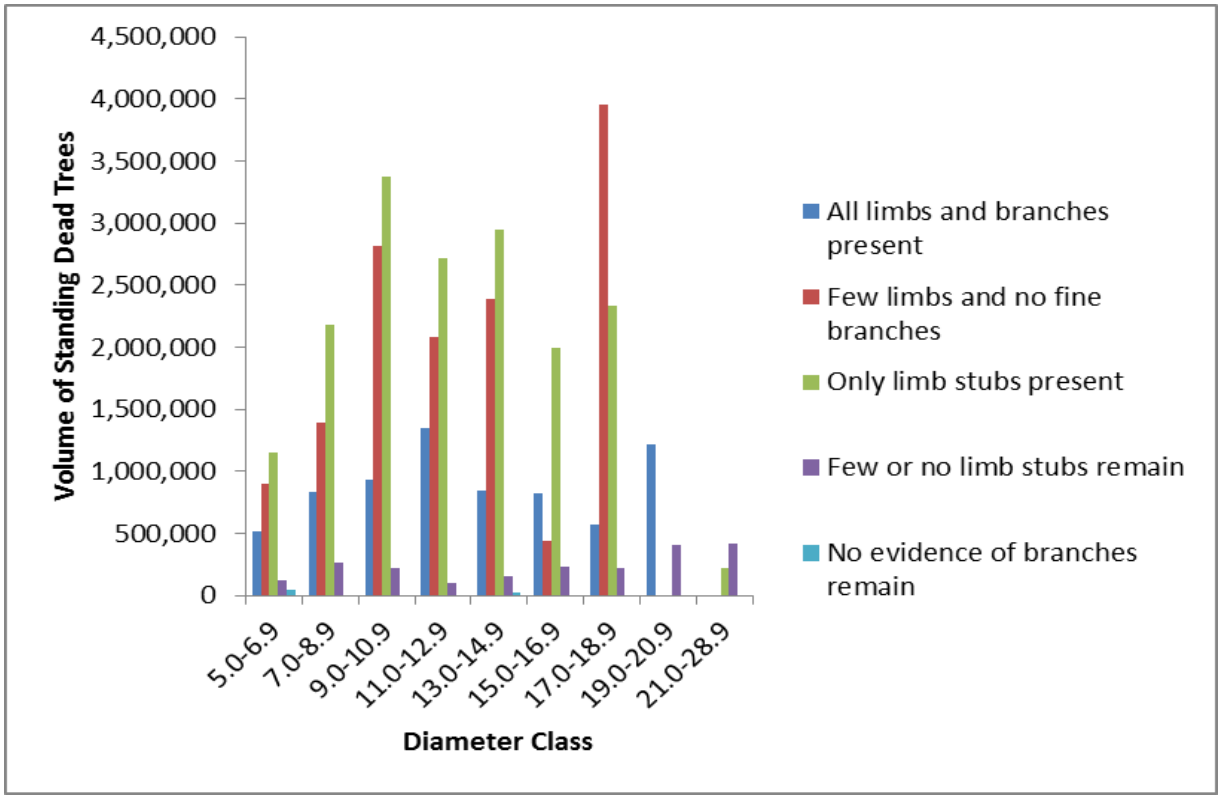

Figure 63. Total volume (cubic feet) of standing dead trees (5" and greater) by tree decay class (FY 2012)

The highest volume of standing dead trees on the ANF in FY 2007 fell within the medium stand size class (5.0-10.9 inches diameter for hardwoods, 5.0 to 8.9 inches for softwoods; Figure 64). In FY 2012, the highest volume of standing dead trees fell within the large stand size class (11.0 inches and greater diameter for hardwoods, 9.0 inches and greater for softwoods). Trees in the smallest stand size class (less than 5 inches diameter) contributed the least to overall standing volume of dead trees on the ANF. From FY 2007 to FY 2012, standing dead trees in the largest stand size classes increased while those in the medium and small stand size classes declined.

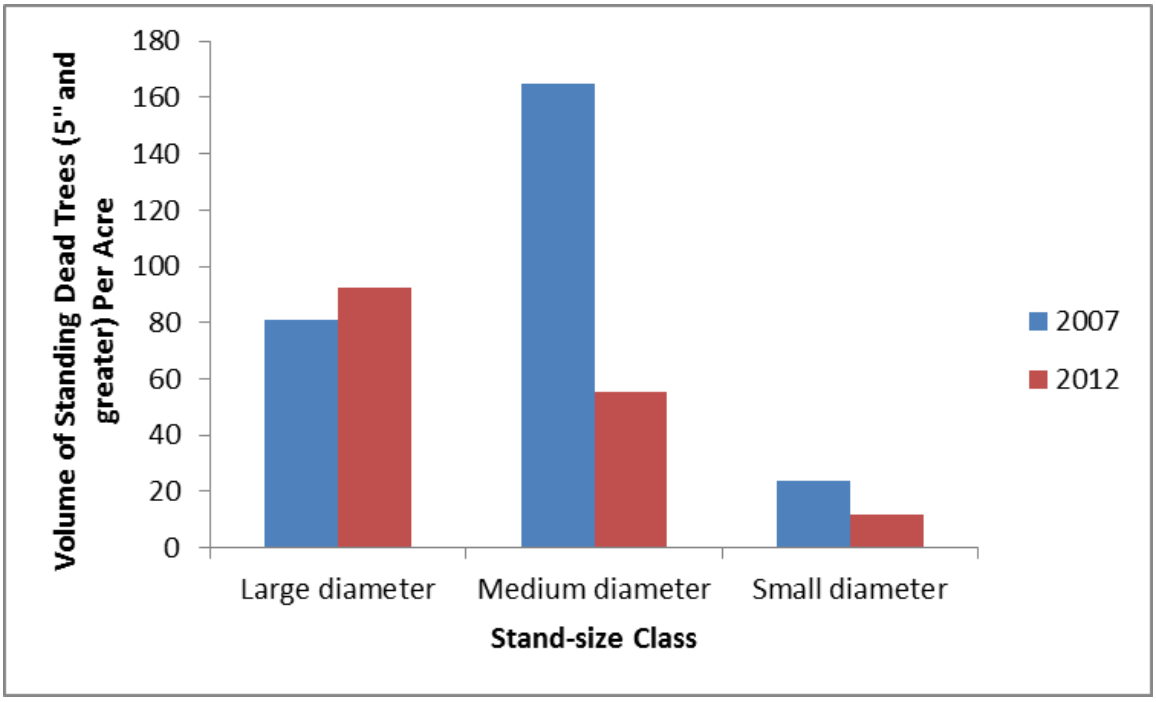

Figure 64. Total volume (cubic feet) of standing dead trees (5" and greater) per acre by stand size class (FY 2007 and FY 2012)

Downed woody debris

The vast majority of coarse woody debris volume on the forest floor in both FY 2007 and FY 2012 was in the largest stand size classes (11.0 inches and greater diameter for hardwoods, 9.0 inches and greater for softwoods; Figure 65). The small stand size class (less than 5 inches diameter) provided the least amount of coarse woody debris. From FY 2007 to FY 2012, the estimated volume of coarse woody debris declined in large and medium stand size classes and remained steady at very low volumes in the smallest stand size class.

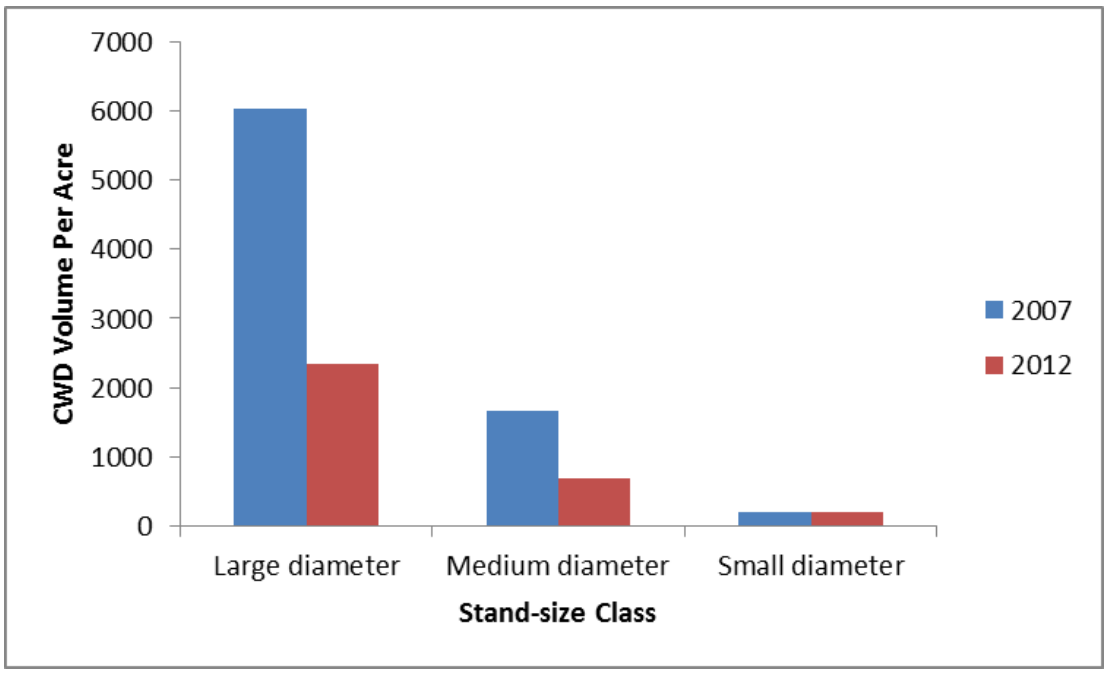

Figure 65. Total volume (cubic feet) of coarse woody debris per acre on by stand-size class (FY 2007 and FY 2012)

Conclusions – Forest Plan desired conditions include sustaining snags throughout the ANF, with large down wood present to meet the needs of wildlife species (USDA-FS 2007a, p. 11). FIA data indicate that an abundance of standing dead trees of all sizes and stages of decay as well as down coarse woody debris in all stand size classes is present on the ANF. Standing dead trees in the least decayed classes indicate that snag recruitment is occurring. The higher volume of trees in the more advanced decay classes indicates that standing dead trees are persisting as snags for some time.

Between FY 2007 and FY 2012, standing dead trees in the largest stand size class increased while those in the medium and small stand size classes declined. During that same period, inventory results indicate a decline in the volume of coarse woody debris in the large and medium stand size classes on the ANF. This is likely the result of the large pulse of snag recruitment and down woody debris inputs that resulted from gypsy moth, maple decline, defoliations and drought caused tree mortality in the 1990s, as well as the BBD complex that now occurs across the entire ANF. At the same time, many of the standing snags in the medium and small classes likely mechanically failed or were blown over between 2007 and 2012. It is anticipated that increases in snags and down woody debris inputs will occur in the next two decades due to EAB and HWA caused tree mortality.

Recommendations – Continue monitoring abundance of standing dead trees and down woody debris on the using various means, including FIA data.

Understory plant species diversity

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
How is understory plant species diversity changing across the landscape?	5 years	5 years	A/B

Protocol – Use inventory data from the FIA database and the detailed data collected during fiscal years 2001, 2003, 2007, and 2011, on the vegetation diversity on the KQDC to assess changes to plant species diversity across the landscape.

Results

Forest Inventory and Analysis database

Detailed plant species composition was measured on 115 FIA plots across Pennsylvania from FY 2007 through FY 2009. Thirty-nine percent of the 519 species identified on these plots were herbs and forbs, and 15% were trees. Sixty-three percent were native to the United States and 16% were introduced. The remainder was unclassified, cultivated, or considered native and introduced. The average plot contained 51 species with a range from 13 to 125 species.

In the Allegheny region, 26% of the sampled plots had adequate advance tree seedling and sapling regeneration of commercial species, and 47% had adequate advance tree seedling and sapling regeneration for canopy replacement species, compared to statewide averages of 46% and 48%, respectively. There are too few of the regeneration sample plots on the ANF to provide specific data for the ANF alone.

More recent preliminary results from the sampling conducted in FY 2013 (McWilliams pers. comm. 2014) indicate steady improvement in tree seedling and sapling regeneration in Wildlife Management Unit (WMU) 2F, which contains the ANF. Using the panels of data collected in FY 2008-2012 or FY 2009-2013, more than half of the sampled plots were adequately stocked with advance tree seedling and sapling regeneration for replacement of canopy species (Figure 66). Due to high variability and small numbers of plots, this result does not reflect statistically significant improvement, and continued monitoring is encouraged.

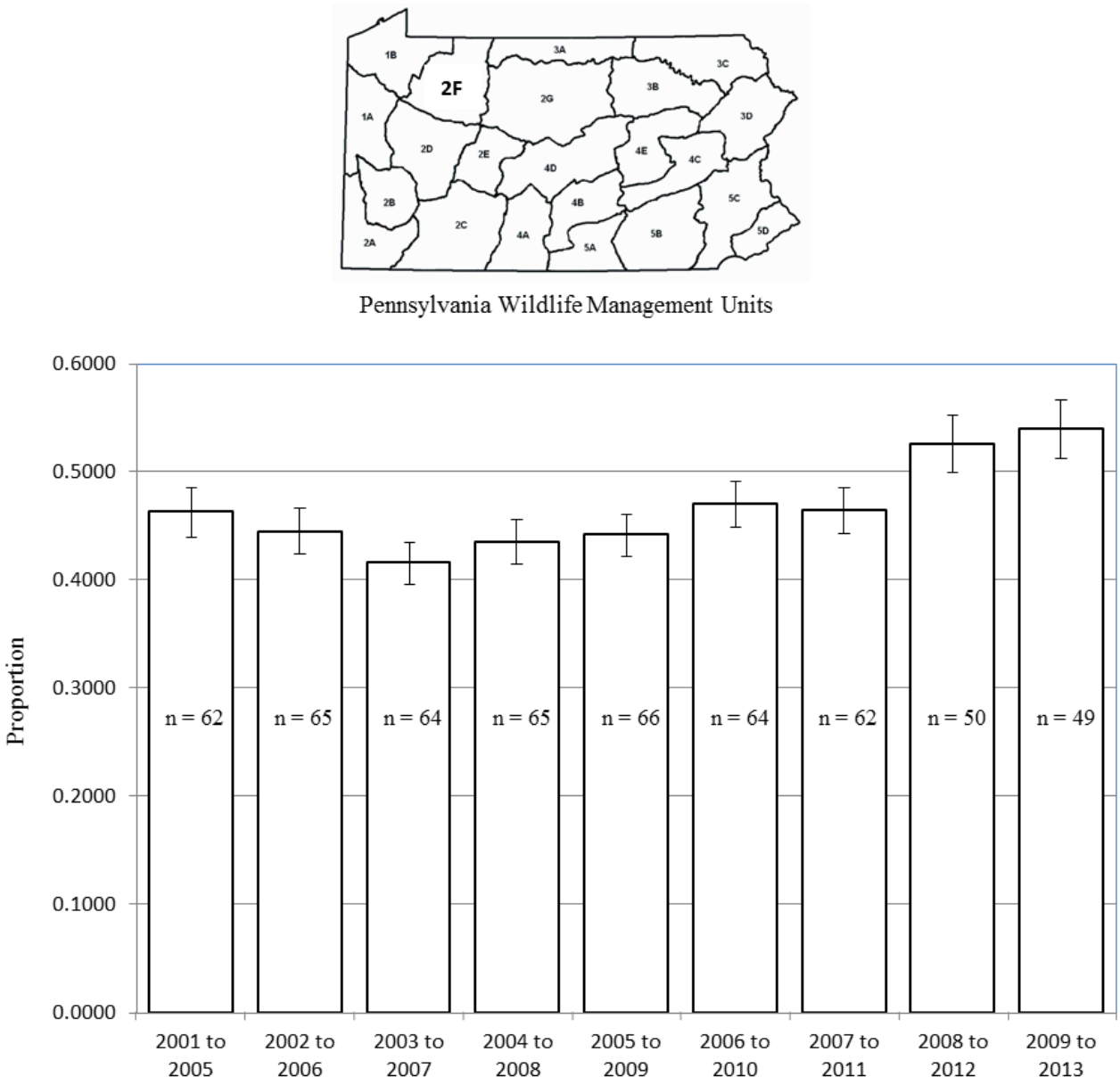

Figure 66. Proportion of samples adequately stocked with advance tree seedling and sapling regeneration for canopy replacement species, Wildlife Management Unit (WMU) 2F, Pennsylvania (FY 2001-2005 to FY 2007-2013)

Kinzua Quality Deer Cooperative

By 2007, several herbaceous species known as indicators of deer impact (*Trillium* spp., *Maianthmum canadense*, and *Medeola virginiana*) had increased in abundance, size, and/or percent flowering (Royo et al. 2010). At that time, four years after implementation of DMAP and associated herd reduction, there were no significant changes in advance regeneration of tree species. Authors of the 2010 report on the 2007 data speculated that the persistence of dense low canopy layers and fern carpets on the forest floor, all consisting of species of low preference and/or high resilience to deer, was slowing the recovery of advance tree seedling regeneration. By 2011, some significant tree seedling recovery was apparent

for some species, with red maple, sugar maple, ash, and birch all at significantly higher seedling densities than they had been at the beginning of the study (Stout et al. 2013).

Conclusions – Forest Plan desired conditions include restoring understory vegetation and vertical diversity, where understory vegetation consists of multiple vegetative layers characterized by a diverse overstory, woody midstory, and well developed understory of shrubs, herbaceous plants and tree seedlings. A diverse understory of vascular plants, woody shrubs, and tree seedlings and a midstory of saplings with an overstory of large mature trees provide complete vertical structure that supports a diversity of wildlife (USDA-FS 2007a, p. 11). Forest Plan goals include providing a diversity of vegetation patterns across the landscape that includes a variety of healthy functioning vegetation layers (USDA-FS 2007a, p. 14).

Landscape-level monitoring results indicate that understory species diversity is slowly improving on the ANF, primarily associated with reduced deer browsing impacts (see *Manage white-tailed deer populations*). Due to the persistence of dense low canopy layers and fern carpets on the forest floor, tree seedling diversity has made a slower, but evident recovery as well.

Recommendations – Continue monitoring forest understory vegetation composition and structure using a variety of data sources and partners.

Reduce impacts to plant species with viability concerns

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
Are project mitigation measures effectively reducing impacts to existing locations of plant species with viability concerns?	Annual	5 years	A/B

Protocol – NRIS-TESP is the corporate database for inventory and mapping data for federally endangered or threatened and RFSS plants. The protocol for collecting data is contained in USDA-FS 2008b.

Results – There are two stands from the Meads Mill project area (Grunder East timber sale payment units 3 and 4) which had locations of plant species with viability concerns in which timber harvest activities took place (payment unit 3 cut date-August 29, 2012, and payment unit 4 cut date-September 26, 2013). A buffer area was established around the populations and will be monitored in FY 2014. The Millsteck project had one unit with plant species with viability concerns in which the unit was dropped from harvest due to occupied habitat being found throughout the stand.

Conclusions – Currently there are several areas being treated for NNIP where plant species with viability concerns also occur. Seasonal timing and type of treatments are successfully being used to limit impacts, and without treatment suitable habitat would be degraded or lost.

Recommendations – Monitoring of the Meads Mill project area locations will occur in FY 2014 and beyond if needed. Use monitoring results for determining what future actions to take (if any) for the Meads Mill project units to provide suitable habitat for species with viability concerns.

Federally listed plant species conservation measures

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
If federally listed plants have been identified, what conservation measures are being implemented?	Annual	5 years	A

Protocol – NRIS-TESP is the corporate database for inventory and mapping data for federally endangered or threatened and RFSS plants. The protocol for collecting data is contained in USDA-FS 2008b.

Results – Above-project and project-level surveys for federally listed small whorled pogonia (*Isotria medeoloides*) and northeastern bulrush (*Scripus ancistrochaetus*) have been conducted in areas proposed for management activities such as, but not limited to: timber harvest, road construction, and wildlife opening construction. No federally listed plants have been documented.

Conclusions – If federally listed plants are documented, follow Forest Plan direction (USDA-FS 2007a, p. 84). Conservation measures found in the Biological Assessment and the USFWS Concurrence Letter (USDI-FWS 2007) completed for the 2007 Forest Plan would also apply.

Recommendations – A re-analysis of the Small Whorled Pogonia Habitat Model was completed in 2010 and has a better representation of characteristics than the previous model of individual/groups of pixels (Figure 67). Additional work in the field is needed for evaluating the new model.

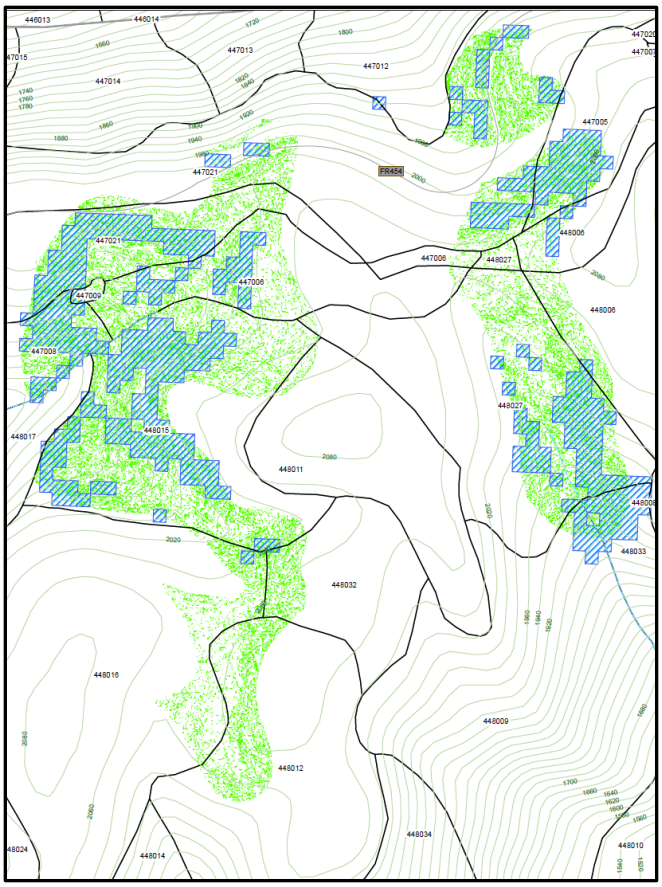

Figure 67. Comparison of 2005 (blue and white striped) and 2010 (green) Small Whorled Pogonia Habitat Model

Project-level surveys for federally listed small whorled pogonia have been conducted for over 25 years on the ANF with no documented occurrences. It is recommended to work with the USFWS to modify our surveying techniques and protocols due to this lack of finding over a long period of time.

Minerals and Geology

Oil and gas developments meeting Forest Plan design criteria

Monitoring Question	Monitoring Frequency	Evaluation Frequency	Precision/ Reliability
To what extent are new oil and gas developments meeting Forest Plan design criteria?	Annual	5 years	A/B

Protocol – As stated in the *Approval and Declaration of Intent*, legal cases decided since the 2007 Forest Plan was affirmed with instructions have provided additional guidance regarding severed mineral estate development on the ANF. The ANF uses the protocol discussed in the *Identify resource concerns associated with oil and gas development* section to avoid, mitigate, and resolve resource concerns

associated with OGM development. The ANF may negotiate mitigation measures with operators consistent with 2007 Forest Plan standards and guidelines, BMPs, or best available science.

Results and Conclusions – The ANF is not comprehensively tracking to what extent new OGM developments are meeting 2007 Forest Plan design criteria since Notices to Proceed associated with outstanding and reserved mineral development are being evaluated under 1986 Forest Plan standards and guidelines. As noted in the *Identify resource concerns associated with oil and gas development* section, mitigation, avoidance, and resolution of resource concerns are typically qualitatively documented in case-specific, project, and personal communication records.

Recommendations – The ANF should change the 2007 Forest Plan in a manner that is consistent with the legal cases that have been decided since the Plan was affirmed with instructions.

Research Questions

Research items were included in the 2007 Forest Plan (Table 16; USDA-FS 2007a, p. 52) with the expectation that their study would develop new information pertinent to Forest Plan desired conditions. They are not a Forest Plan decision. The status of the research questions is included in Table 68.

Table 68. Status of Forest Plan research questions

Resource Area	Research Question	Status
Soil	To what extent is soil acidification affecting the physical, chemical, and biological processes and functions?	Regional issue; ongoing research is occurring across the northeastern United States. In 2013, soils were sampled and tested from 11 soil pits located in different watersheds and landscape positions across the ANF. The results for these samples have not been analyzed yet. Additional sampling and testing is planned in 2014.
Wildlife	What is the impact of the HWA to wildlife on the ANF, specifically, impacts to northern flying squirrels, impacts to species that utilize hemlock for thermal cover (deer, turkey, grouse) and species that utilize hemlock for nesting (Blackburnian warblers, Swainson's thrush)? Which conifer species should be planted in place of hemlock to meet the needs of wildlife?	Regional issue; a number of research studies regarding the effects of HWA caused hemlock mortality are ongoing across the eastern United States. The ANF has partnered with The Nature Conservancy to develop a collaborative all-lands strategy for hemlock conservation in the face of HWA. The strategy covers much of the 212Ga subsection (Northern Allegheny Plateau section, High Allegheny Plateau subsection) which totals 1.7 million acres). This strategy will include some discussion on what conifer species landowners should consider for planting to replace hemlock killed by HWA.
	What are the direct impacts of roads to rattlesnakes, wood and box turtles, amphibians and other less mobile species? At what landscape threshold of road density and/or traffic level do species declines begin to occur?	Rattlesnake telemetry project with PFBC.
	Quantify the benefits of the landscape linkages to specific wildlife species in terms of: (1) facilitating genetic interchange between sub-populations, (2) facilitating movement of less mobile species, and (3) enhancing species resiliency. At what level of activity (road building, timber harvesting, trail construction, OGD	Ongoing; a landscape-level deer interaction study by NRS and others is currently underway, and includes sites on the ANF. A related study was recently completed by scientists at NRS, which included sites on the ANF and evaluated effects of shallow OGD on forest songbird communities.

	and stone pit development) do the above three benefits begin to decline? What is the optimal corridor width for specific wildlife species?	
	Given the current distribution of early structural habitats across the ANF, are any wildlife species declining because these habitats are not better connected?	This is a regional issue being studied by various scientists. The ANF has areas included in an ongoing study by NRS and others looking at temporary opening sizes as they relate to utilization by various bird species.
	At what deer density is vegetation diversity and hunter satisfaction optimized?	Ongoing; NRS, ANF and a number of partners have been working on the KQDC since 2000.
Vegetation	What integrated pest management activities, including silviculture treatments, will help sustain healthy hemlock in the face of the expected HWA infestation?	Regional issue; numerous studies are occurring across the eastern United States. The ANF is collaborating on an ongoing study with NRS evaluating thinning as a technique to improve survivability of eastern hemlock subsequently infested by HWA.
	How can greater success be achieved in developing sugar maple seedlings or retaining existing healthy sugar maples, in order to sustain this species on appropriate sites on the ANF?	Regional issue; ongoing research is occurring across the range of sugar maple. NRS scientists locally continue to monitor sugar maple health, flowering, seed production and seedling establishment. This includes re-measurement of a long-term study on applying lime in sugar maple forests and effects on tree seedling regeneration.
	How can we sustain healthy American beech? What activities will successfully regenerate beech seedlings that are resistant to the disease complex in the long term?	Status documented in Salmon West EA, Appendix D–Response to 30-Day Comments.
	What are the most economical and biologically feasible methods for: • sustaining a diversity of tree species and forested conditions under even-aged management? • ensuring diverse tree species develop and remain competitive in young stands? • regenerating oak?	Various studies on the ANF and regionally are underway regarding sustaining and maintaining a diversity of tree species in regenerated forests. Scientists at NRS are currently evaluating probabilities of dominance by various species in young forests, and how land managers can sustain desired and diverse species composition. Additionally, the ANF and other land managers have been engaged with scientists from NRS to research methods to effectively regenerate and sustain oak forests on the ANF and surrounding region.

	What preventative/remedial strategies are available to respond to gypsy moth, cherry scallopshell moth, and EAB outbreaks and cherry red rot, ash die-back, and sudden oak death diseases?	There are various research studies completed or ongoing across the eastern and mid-western United States to evaluate strategies to sustain healthy forests in the face of various native and introduced forest pests and disease. One ongoing study on the ANF being conducted NRS scientists is evaluating landscape level baseline ash health in advance of emerald ash borer infestation.
	Investigate when the Allegheny hardwood forest type can be expected to substantially declined based on the following criteria: seed production, value, prevalence of internal defect, and tree mortality	The ANF has been collecting data and monitoring black cherry crown health for several years, NRS scientists have been studying the same along with black cherry flowering and seed production. ANF staff and NRS scientists initiated a new study in FY 2014 to more formally evaluate black cherry crown health, seed production, and reproductive capability.

Summary of Results and Recommendations

The ANF has completed its sixth full year (FY 2008-2013) of monitoring and evaluation under implementation of the 2007 Forest Plan. Results and recommendations by monitoring item are summarized in Table 69. Evaluation of information for all monitoring items indicates the ANF should change the 2007 Forest Plan in a manner that is consistent with the legal cases that have been decided since the Plan was affirmed with instructions.

Table 69. Summary of results and recommendations by monitoring item

Description	Results	Recommendations
Minimum Legally Required Monitoring Items		
Stocking within five years of regeneration harvest	Restocking success rate (including probable success): 98.5% (even-aged green final harvest), 100% (even-aged green two-aged harvest), 88.2% (even-aged salvage final harvest), 100% (even-aged salvage two-aged harvest), 93.8% (uneven-aged green harvest), and 78.8% (uneven-aged salvage harvest).	Continue to monitor tree seedling development success and the need for additional reforestation treatments to assure timely and adequate tree seedling stocking in regeneration harvests. Continue to implement uneven-aged treatments through an adaptive management approach taking into account the direction noted in the 2007 Forest Plan.
Maximum opening size from even-aged management	Final harvest size followed MA direction.	Continue monitoring the size of temporary openings created through shelterwood removals, clearcuts, or two-aged harvests to ensure Forest Plan standards and guidelines are met.
Destructive insects and diseases	Numerous stressors, native and introduced insects and diseases threaten the health of ANF forest ecosystems.	Continue insect and disease detection and monitoring activity as a cooperative effort with FHP. Maintain health of forest stands through integrated pest management strategies.

Description	Results	Recommendations
	Recent introductions of HWA and EAB are of particular concern as well as continued mortality and changes in forest structure resulting from BBD. The four-county area of Pennsylvania in which the ANF is located, is in attainment of all the NAAQS except SO_2.	Enhance the diversity of forest vegetation in terms of composition and structure in order to improve resiliency of the forest and the reduce level of impact from insects and diseases, particularly those that are introduced. For those insects and diseases that present new threats to Forest tree species (such as EAB, HWA, and SWW), continue monitoring for their presence on the ANF and develop and implement strategies and action plans for these pests that integrate newly identified or state-of-the-art pest control techniques. Continue monitoring overall health and status of affected tree species. Continue to assess the need for public education (firewood movement) and monitor effectiveness of education and outreach efforts.
MIS – cerulean warbler	The ANF population of cerulean warblers appears to not be suffering the decline reported in other parts of the state. Preferred nesting habitat has dropped slightly, but still represents 72% of oak forest types on the ANF.	Continue to survey cerulean warbler preferred nesting habitat during songbird survey routes. Implement the cerulean warbler monitoring study proposed for the Salmon West project with the objective of determining if cerulean warblers respond to structural changes to oak forest due to silvicultural treatments. Continue to maintain the integrity of cerulean warbler habitat by implementing the management emphasis outlined in the Forest Plan FEIS.
MIS – northern goshawk	While ANF territories mirrored the reduced reproductive success exhibited in the CAGP, territory activity between FY 2008 and FY 2013 (15 territories documented as active)	Continue working with Dave Brinker of the CAGP to monitor known northern goshawk territories. Review the results of Ian Gardner's habitat suitability model. Habitat analysis should continue in an effort to correlate habitat preferences and quality with nesting activity and success.

Description	Results	Recommendations
	was comparable to historic activity levels and nest success has turned since FY 2012. This suggests northern goshawk populations on the Forest have continued to remain relatively stable over the long-term (since 1986).	Continue to maintain the integrity of northern goshawk habitat by implementing the management emphasis outlined in the Forest Plan FEIS.
MIS – timber rattlesnake	The telemetry program with PFBC confirmed 21 new dens including three on the Bradford Ranger District which did not have any timber rattlesnake dens identified prior.	Continue to work closely with PFBC and implant additional transmitters in adult snakes with a goal of locating new dens. Continue participation in the Timber Rattlesnake Conservation Work Group to stay up-to-date on population status and hunting regulations. Make recommendations in regards to restricting hunting in parts of the ANF where populations are struggling. Maintain the integrity of den sites by reducing or removing human activities that have a high risk of causing rattlesnake mortality. Consider manipulating vegetation at den sites where basking and foraging habitat has become limited. Continue public education efforts to reduce fears and increase appreciation for this sensitive species. During the timber rattlesnake spring emergence period lasting through June, ANF staff should increase efforts to locate new dens and visit all known dens to ensure that habitat integrity is being maintained. While at the den sites, collect information such as number of adult snakes and neonates observed, and the sex of adults observed.
MIS – aquatic invertebrates	Aquatic macroinvertebrate diversity and relative abundance on the ANF is being sustained on the majority of the ANF.	PADEP recommends that future acid deposition projects and funding should be focused on treatment of the six streams revealed not to be in attainment of their designated aquatic life use during the Aquatic Biology Investigation study. Alkalinity is nearly or completely absent in the majority of these six streams. Assuming proper construction, maintenance, and operation, passive treatment systems could raise alkalinity and pH in these streams, leaving them less susceptible to dissolved aluminum toxicity.

Description	Results	Recommendations
	Aquatic habitat is not the limiting factor in streams. Water quality, rather than aquatic habitat, is more limiting for macroinvertebrates in numerous streams due to low pH.	The remaining streams examined during this study should continue to be monitored, particularly in the fall, to document possible degradation of macroinvertebrate assemblages and other aquatic life. Clarion University of Pennsylvania recommends the sampling of macroinvertebrates in pools if additional surveys are conducted as follow-up to their assessments of OGD, and PADEP recommends resurvey of the Chappel Fork watershed macroinvertebrate community is completed until full recovery is documented. USACE recommends the sampling of tributaries to the Allegheny Reservoir and Allegheny River should continue. Overall, macroinvertebrate surveys should continue as they can provide an early warning of hazardous changes in water quality, detect episodic events such as pollution spills, evaluate recovery from disturbed conditions, and reveal trends and cycles. It is also recommended that the ANF inventory watersheds identified with sediment sources and apply or improve BMPs at the areas of concern. The ANF should continue surveying roads for sediment contributions to water ways so that these sediment sources can be mitigated. Additionally, habitat improvement projects should be focused on projects where water quality is suitable for aquatic organisms.
MIS – mourning warbler	The ANF population of mourning warblers appears to be decreasing; however, this is in sharp contrast to Pennsylvania Breeding Bird Atlas results and could be an artifact of low survey effort. Suitable habitat has been reduced by 49% since the start of 2007 Forest	Continue to survey mourning warbler suitable habitat during songbird survey routes. Restore some of the lost mourning warbler habitat by implementing the management emphasis outlined in the Forest Plan FEIS to address the species.

Description	Results	Recommendations
	Plan implementation and represents 3.4% of forest land on the ANF.	
Effects to lands and communities adjacent to or near the National Forest and effects to the ANF from land managed by government entities	The ANF effects local communities through payments to local counties ($23.5 millon), the value of timber sold and harvested ($45.6 million and $46.7 million, respectively), stewardship contracting ($10.1 million), the value of service, construction, and supply contracts ($19.9 million), partnerships (352 valuing $11 million), and special use permits (35 active special use permits for recreation on the Forest).	Continue monitoring local and regional economic trends as well as ANF economic benefits to local communities and local and rural economies. Further coordination with local governments to acquire and discuss socioeconomic data and trends will help the ANF assess its contribution toward this monitoring item.
Comparison of projected and actual outputs and services	Resource areas made varying levels of progress on moving current conditions toward the desired conditions described in the Forest Plan. The average annual timber volume awarded was 58% of ASQ.	Recreation activities: *Facilitate regular grooming of snowmobile trail system*, *Develop and design equestrian trails for equestrian use*, *Manage wilderness areas to meet Wilderness Stewardship Challenge)*, and *Resource damage from equestrian use outside equestrian use areas* Prescribed burning by resource objective: *Use prescribed fire to enhance ecosystem resiliency* Reforestation activities: *Conduct pre-commercial thinning or release in regenerated stands* and *Treat acres to increase plant species diversity*

Description	Results	Recommendations
		Fuels, NNIS, wildlife, fish, and stream activities: *Use prescribed fire and mechanical treatments to reduce hazardous fuels, Treat invasive plants, Enhance terrestrial wildlife habitat, Complete fish habitat improvement projects, and Complete stream restoration/enhancement projects* Transportation activities: *Maintain roads, Decommission roads no longer needed,* and *Surface roads with limestone* Timber management practices by MA: Maintain or increase implementation rates, with a particular emphasis on increasing final harvest rates within MA 3.0. Continue monitoring outputs and services designed to move the Forest towards desired landscape-level vegetation conditions.
Prescriptions and effects	Silvicultural prescriptions integrated various resource considerations and met objectives to move landscapes toward desired conditions established in the Forest Plan. All prescriptions evaluated retained a diversity of tree species.	Continue monitoring implementation of silvicultural prescriptions in all types of prescriptions. Continue utilizing relative density measures of stand crowding in silvicultural prescription development. Continue utilizing local guidelines for silvicultural prescription development in Allegheny Plateau hardwoods (Marquis, et al. 1994). Continue utilizing the standardized ANF silvicultural prescription template designed to ensure all measurable components of silvicultural prescriptions are addressed, including long-term objectives. Ensure that the inventory used to write a prescription accurately represents conditions on the ground. Collect updated inventory data in the following situations: • Existing data are older than 10 years old. • Original stand boundaries are significantly differently than actual treatment boundaries. • When it is suspected that stand composition, stocking, or distribution has changed since the last inventory (e.g. BBD, windthrow, general decline, etc.). Where a clumped stocking distribution occurs, or mortality such as BBD-caused

Description	Results	Recommendations
		mortality has impacted a stand, the shelterwood seed cut may actually require the residual relative density to fall below 50%. Account for sapling stocking in the prescription when it exceeds 5% of the total stand relative density.
Comparison of actual and estimated costs	Actual expenditures annually averaged 89% of estimated costs with a range of 70% (FY 2012) to 98% (FY 2011); however, the Forest only received and spent an average of 51% and 45% of the total projected cost of full Forest Plan implementation, respectively.	Continue to monitor costs with the objective to efficiently and effectively spend the Forest's allocated budget to meet the needs of Forest Plan implementation.
Effects of management practices	FR 230 timber sale: Standards and guidelines and project mitigation measures were properly applied and were effective in avoiding/minimizing resource damage. Tract 13: The environmental planning process was properly followed and Section 390 criteria were fulfilled. The decision and implementation	FR 230 timber sale**:** There are no findings to recommend changes to standards and guidelines in the Forest Plan at this time. Tract 13: • Continue use of implementation folder on future federal minerals. • Direct oil and gas administrators to reference Erosion and Sedimentation Control Plan requirements and the decision mitigations (Conditions for Approval) in inspections. • When waivers for road construction work are issued in the Notice To Proceed, include timeframes for completion. State the need for final inspection acceptance of all required items. • Multiflora rose should be treated and monitored. 2003 Blowdown salvage sales: The Chappel site should be planted with quaking aspen, butternut, tulip poplar, basswood, and sugar maple. The site also needs to have interfering pin cherry, birch, beech and striped maple felled where they are overtopping

Description	Results	Recommendations
	were consistent with 2007 Forest Plan direction. The proposed access roads and well pads were designed to protect surface resources, with a few noted exceptions. 2003 Blowdown salvage sales: Standards and guidelines and project mitigation measures were properly applied and were effective in avoiding/minimizing resource damage. Smoke monitoring: Both the Upper Millstone and Southwest Reservoir prescribed burns remained well below the human health benchmark for $PM_{2.5}$. National BMP monitoring: The Plan of Operations was implemented as planned, including construction of the site and implementing Erosion and Sedimentation	desirable tree seedlings. Bench cut skid trails should be avoided due to the disturbance to soils and alteration of hydrology. In future blowdown or broad scale mortality assessments: • Consider providing field crews with consistent thresholds to categorize damage. • Where heavy and moderately heavy blowdown occurs, map reserve areas using a GPS unit that can record coordinates of reserve areas. Smoke monitoring: Continue smoke monitoring during selected prescribed burns. National BMP monitoring: • Provide companies with information on resource concerns to consider during planning process and layout. This exchange of information was actually occurring with two of the larger oil and gas operators on the Forest around the time of this review. • To reduce the changes in water temperature around the wetland, trees should be planted to provide shade around the wetland. • Instead of controlling all the site drainage at one infiltration basin, it may be better to distribute the outflows over multiple locations

Description	Results	Recommendations
	Control Plans. The effectiveness evaluation found evidence of sediment transport to a wetland and the aquatic management zone was too narrow.	
Achievement of Forest Plan Objectives		
LAND AND RESOURCE MANAGEMENT PLANNING		
Develop an Allegheny Reservoir Management Plan	A management plan has not been completed.	Continue to work with Pennsylvania Kinzua Pathways along with other potential partnership opportunities to develop a management plan. Utilize FY 2008 RFA, information from the FY 2010 and FY 2015 NVUM process, and information in private concessionaires' annual Operation and Maintenance Plans for developed recreation areas to develop management plan.
NOXIOUS WEEDS		
Establish seed and mulch mixes that limit spread of invasive species	Some species recommended by the Ruffed Grouse Society and the Pennsylvania Biological Survey's Vascular Plant Technical Committee have been included in test locations on the ANF.	Refine seed mixes for timber sales and road work so that desirable cover is met. Work with native seed suppliers to produce genetically appropriate seed that is readily available for use on the ANF.
Treat invasive plants	Invasive plant treatments (Forest Plan objective): 622.2 total, 103.7 acres, annually (300-600 acres, annually).	Analyze additional chemicals and treatment methods to effectively conduct NNIP treatment, e.g., use of basal bark treatment for glossy buckthorn. Analyze where NNIP treatment is needed in MAs that have not been included in project-level analyses and are not anticipated to be included in the near future, e.g., west side of the Allegheny Reservoir.
RECREATION		

Description	Results	Recommendations
Manage CUAs to prevent resource damage	Dispersed sites have been extensively inventoried and either maintained, rehabilitated, or closed to prevent resource damage.	Continue to inventory and evaluate dispersed sites during project-level planning. Continue to utilize FPO and LEO patrols in areas where investments have been made to prevent overcrowding during peak seasons, minimize health and safety concerns, and resource degradation.
Manage for ROS settings	Proposed project activities have met established ROS settings.	Continue to use ROS as a primary indicator for measuring effects in project-level recreation analysis.
WILDERNESS AREAS		
Manage wilderness areas to meet Wilderness Stewardship Challenge	Minimum stewardship levels of the Wilderness Stewardship Challenge have been met.	Continue to work with volunteers (FAW and students) and seasonals to make progress with the Wilderness Stewardship Program. Explore opportunity to work with University of Pittsburgh at Bradford students to develop a wilderness education resource guide (pre-trip, field trip, and post-trip activities) for middle school teachers/students. Implement the Wilderness Stewardship Challenge: Air Quality Values Monitoring Plan recommendations.
TRAILS		
Establish trail classes, permitted uses, construction, reconstruction, and maintenance priorities	Trail classes, permitted uses, maintenance, and construction priorities have been identified. 26.8 miles of non-motorized trails and 17.4 miles of motorized trails were constructed or reconstructed, annually.	Continue to maintain existing trails through volunteer and cooperative group agreements along with hosted program personnel (SCA, YCC, FCI-McKean Prison Crew). Only consider new trail construction proposals from sponsored groups who wish to connect ANF land to services that would benefit Forest trail users and are willing to help support and fund the planning, design, construction, and long-term maintenance of new trails. Utilize information collected in FY 2015 NVUM process to verify Forest trail use.

Description	Results	Recommendations
	All limited use trails suitable for conversion to multiple use have been converted.	
Evaluate ANF road system for suitable snowmobile use	Roads and trails designated for snowmobiles are found on the 2012 Snowmobile Trails Map. In partnership with the Pennsylvania State Snowmobile Association, the snowmobile trail system was marked and signed in FY 2013.	Continue to maintain a Snowmobile Trails Map to show where it is legal for the public to ride.
Facilitate regular grooming of designated snowmobile trail system	Met Forest Plan objective of regular trail grooming during favorable conditions.	Continue to seek out long-term maintenance projects with volunteers to enhance grooming opportunities.
Design and develop equestrian trails for equestrian use	38 miles of the Spring Creek horse trail were newly constructed.	Pursue potential opportunities for new horse trails and maintenance and expansion of the Spring Creek Horse Trail as they are presented.
Provide snowmobile system connectors	No new connectors built.	Pursue potential opportunities as they are presented.
HERITAGE		

Description	Results	Recommendations
Develop management plans for preservation of cultural resources	No management plans were developed for any eligible and potentially eligible sites on the ANF.	Portions of a Heritage Management Plan have been created to date in FY 2014 and additional sections are being developed. It is recommended that this progress continue.
Evaluate heritage sites	39 sites were evaluated and one was nominated for the National Register of Historic Places.	To reduce the backlog of heritage sites that require evaluation for the National Register of Historic Places, the ANF will need to provide greater funding for the heritage program. This funding can be used to either hire additional staff or use it to hire contractors to complete the evaluations for the Forest.
Develop inventory of culturally sensitive sites with Seneca Nation of Indians	An inventory has not been developed. Two formal consultation meetings were held between the ANF and SNI.	Continue to foster relationship with the SNI by continuing to consult with them on specific projects and hold annual meetings with the SNI, the Forest Supervisor, and the Heritage Program Manager.
SCENIC INTEGRITY		
Maintain or exceed scenic integrity levels	All vegetation management project activities have met established SILs from CL 1 or 2 view facilities. Not all OGM developments have met SILs from CL 1 or 2 view facilities.	Continue to use SIL as a primary indicator for measuring effects in project-level scenery management analysis.
Maintain existing and construct new scenic vistas	6 existing scenic vistas were maintained. No new additional vistas were constructed.	Pursue potential partnership opportunities to help maintain existing scenic vistas. Continue to look for potential new scenic vista opportunities in planned projects.
VEGETATION		
Provide vegetative diversity across the landscape	Current condition (Forest Plan objective):	Increase regeneration treatments in order to move forest age class and structural stage distribution toward desired conditions in the Forest Plan.

Description	Results	Recommendations
	3.4% (8%) early structural, 76.3% (72%) mid structural, 10.3% (10%) late structural.	
Maintain or create age class diversity on lands suitable for timber management	Even-aged treatments sold (Forest Plan objective): 2,863 acres total, 477 acres, annually (1,400-1,800 acres, annually); Uneven-aged treatments sold (Forest Plan objective): 106 acres total, 18 acres, annually (300-700 acres, annually).	Increase regeneration treatments using even-aged and uneven-aged methods in order to move toward achieving Forest Plan objectives, as funding and staffing permit. Continue monitoring progress towards achievement of desired vegetation conditions.
Conduct pre-commercial thinning or release in regenerated stands	Pre-commercial thinning and release treatments implemented (Forest Plan objective): 2,955 acres total, 492 acres, annually (500-2,500 acres, annually).	Continue monitoring composition, diversity, and competitive interactions of tree species in young stands to assess the need for release or pre-commercial thinning activities. Continue monitoring progress toward achievement of young stand tending activities, such as release and pre-commercial thinning.
Use prescribed fire to enhance ecosystem resiliency	Prescribed burn treatments implemented (Forest Plan objective): 972.1 acres total, 162 acres, annually (75-400 acres, annually).	Out-year prescribed fire planning will gear toward treating larger burn blocks to utilize good burning days and effective use of personnel. For the Buzzard Swamp Wildlife Management Area, coordinate with wildlife staff and PGC to mow fewer areas where there are plans for prescribed fire.
Utilize salvage sales to achieve multiple use objectives and recover timber value	866 acres of storm or fire damaged trees were identified and considered for salvage harvest to recover	Continue monitoring overall forest health, including rapidly occurring catastrophic events such as wind and ice storms, along with slower moving disturbances, such as the decline and mortality caused by BBD. Future threats to forest health that may warrant recovery of economic value of timber include ash mortality caused by EAB, and hemlock mortality resulting from HWA.

Description	Results	Recommendations
	economic value of timber in MAs 1.0 and 3.0. The ANF has already or has plans to salvage timber on 79% of these damaged areas within two years of the catastrophic event. An additional 5% is scheduled to be sold within six years of the event where the damage took longer to manifest itself. The remaining 16% will not be salvaged due to potential resource or access concerns, or because the dead and down trees contribute toward desired vegetation objectives.	
Maintain a minimum conifer component	Current condition (Forest Plan objective): a conifer component of greater than 15 ft^2 basal area/acre is present on 15% of the ANF (10%).	Continue monitoring forest vegetation to ensure adequate conifer cover is maintained.
Maintain a minimum oak component	Current condition (Forest Plan objective): an oak component of greater than 15 ft^2 basal	Continue monitoring forest vegetation to ensure adequate oak cover is maintained. Reintroduce fire and other disturbance necessary to ensure oak ecosystems are sustained in the future.

Description	Results	Recommendations
	area/acre is present on 18% of the ANF (15-20%).	
Maintain minimum percent forest cover	Current condition (Forest Plan objective): forest cover is present on 92% of the ANF (70%).	Continue monitoring forest vegetation on the ANF to ensure at least 70% forest cover is maintained.
Provide minimum percent grass and shrub openings	Current condition (Forest Plan objective): grass and shrub openings are present on 2.8% of the ANF (2%).	Continue to maintain existing herbaceous openings with the use of prescribed burning and top dressing. Consider the spatial distribution of herbaceous and shrub openings during project planning and make recommendations to enhance benefits of existing openings or to create new openings where necessary.
Maintain moderate to well-stocked stands	Current condition (Forest Plan objective): moderate to well-stocked stands are present on 94.4% of the ANF (90%).	Continue monitoring forest stocking levels to ensure moderate to well-stocked stands are maintained.
WATERSHED AND AIR		
Complete soil and water restoration projects	Soil and water restoration projects completed (Forest Plan objective): 670 acres total, 111.7 acres, annually (10-50 acres, annually).	Follow a holistic approach to address watershed concerns. Use monitoring data to determine the cause of pollution or lack of watershed productivity. Complete Watershed Restoration Action Plans to ensure all projects impacting water quality problems are addressed. Utilize WIT to track the location of projects, funding information, and time period it was accomplished. Continue to work with Allegheny WINs Coalition partners to complete important restoration projects.

Description	Results	Recommendations
		Continue monitoring of alkalinity treatment methods to determine effectiveness and implement in other watersheds impaired by acid deposition. Determine if additional thinning is needed on the hillside at the Corydon Cemetery Restoration project.
Restore compositional/structural diversity to riparian corridors	Riparian acres treated (Forest Plan objective): 0 acres total (50-100 acres, annually). 27 acres were approved for thinning.	Identify opportunities for vegetation treatments to improve riparian corridors in vegetation management projects. Conduct thinning treatments of hemlocks stands and monitor for HWA. More research is needed to determine if attraction of HWA to thinned hemlock stands truly is a risk, or if it is more beneficial to improve the health of overstocked hemlock stands. Track aspen regeneration treatments that occur in riparian areas.
WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT		
Enhance terrestrial wildlife habitat	Terrestrial wildlife habitat enhancements implemented (Forest Plan objective): 43,160 acres total, 7,193 acres, annually (1,200-1,600 acres, annually).	Continue to maintain existing herbaceous openings with the use of prescribed burning and top dressing. Consider the spatial distribution of herbaceous and shrub openings during project planning and make recommendations to enhance benefits of existing openings or to create new openings where necessary. Inventory wildlife habitat and propose planting vegetation, installing nest boxes, or creating vernal pools where necessary.
Manage white-tailed deer populations	Current condition (Forest Plan objective): 13.7 deer/mi^2 on the KQDC and 17.3 deer/mi^2 outside the KQDC (10-20 deer/mi^2)	Building upon the two new DMAP Units implemented for the 2014-2015 hunting season, develop a long-term deer management strategy for the ANF to address the distribution of additional new DMAP Units across the Forest and annual deer pellet transect monitoring. Integrate other considerations affecting deer management where possible as appropriate.
Complete fish habitat improvement projects	Fish habitat improvement projects completed (Forest Plan	Continued collaboration with Allegheny WINs Coalition partners is critical to ensure Forest Plan objectives for improving fish habitat are met.

Description	Results	Recommendations
	objective): 1,870.8 acres total, 311.8 acres, annually (30-40 acres, annually).	A permanent Aquatic Ecologist should be filled to manage the fisheries program, including coordination of fish habitat improvement projects with partners. A more formalized reservoir fisheries management plan should be developed to better plan, manage, and coordinate our efforts with partner organizations.
Complete stream restoration/enhancement projects	Stream restoration/enhancement completed (Forest Plan objective): 221 miles total, 38.3 miles, annually (1-2 miles, annually).	Continued collaboration with Allegheny WINs Coalition partners is critical to ensure Forest Plan objectives for improving fish habitat are met. A permanent Aquatic Ecologist position should be filled to manage the fisheries program, including coordination of stream restoration/improvement projects with partners. A more formalized fisheries management plan should be developed to better plan, manage, and coordinate our efforts with partner organizations.
Manage active great blue heron colonies	In FY 2013, there were four active rookeries and since FY 2008 five rookies have been abandoned or relocated.	Continue to pursue reports of new nests and search for new rookeries in high potential nesting habitat. Continue annual monitoring of known rookeries and implement guidelines to protect known rookeries.
Manage occupied northern flying squirrel nesting sites	70 nest boxes were placed in suitable habitat. None are occupied.	Continue to place nest boxes in suitable habitat and monitor annually. Consider a conifer replacement strategy in the event there is a loss of hemlock to HWA.
Manage known locations of plant species with viability concerns	140 known sites on ANF with at least one plant species with viability concern.	Continue surveys to refine data in and add data to NRIS-TESP. Develop another agreement with WPC to conduct additional surveys. Monitoring of known locations is needed to determine if sites are being impacted by non-native invasive species.
Manage suitable habitat for yellow-bellied flycatchers	Suitable nesting habitat occurs across the Forest in the form of 9,249 acres of hemlock stands (1.9% of total forest	Continue to implement standards and guidelines to conserve suitable habitat. Continue to survey potential habitat during songbird survey routes.

Description	Results	Recommendations
	cover) and 10,806 acres of other conifer stands excluding hemlock (2.2 % of total forest cover). None is occupied.	
Manage active red-shouldered hawk territories	The number of active nests increased since FY 2008 with six active nests in FY 2011-2013.	Continue to monitor known nests and field verify reports of new nests.
Manage occupied osprey nesting sites	In FY 2013, there were five active nests. The well-established osprey pairs usually successfully fledge at least one chick per year.	Place osprey poles in suitable areas, and create and retain natural snags where possible. Continue to monitor the activity of known osprey nests.
Prevent introduction of zebra mussels	Objectives for watercraft screens (500 annually) and boat trailer inspections (1,000 annually) were met. 95 (2.1%) of 4,550 watercraft screened were found to be at medium or high risk for zebra mussel introduction. 8 (0.07%) of the 10,446 trailers inspected had vegetation on them. No evidence of zebra mussels found during trailer inspections or dock and shoreline surveys.	Continue with watercraft screenings and trailer inspections at Forest Service boat launches to determine the risk of zebra mussel introduction. This includes many of the scheduled fishing tournaments that in previous years have not been screened, particularly at Elijah boat launch. Renew annual inspections of docks and shorelines on each side of Forest Service boat launches to visually determine if zebra mussels are present. Begin annual SCUBA surveys of hardened surfaces and shoreline below winter pool levels to determine if zebra mussels are present.

Description	Results	Recommendations
Provide optimum and suitable vegetation habitat for Indiana bat	Current condition (Forest Plan objective): Optimal and suitable vegetative habitat on 37% and 56% of ANF, respectively (30% optimal and suitable habitat combined).	Continue to use marking guidelines designed to retain an abundance of roost trees in a variety of size classes.
Maintain or increase productivity of bald eagles	Average annual nest productivity has been 1.4 young per active nest and exceeded the USFWS national recovery objective (1.0 young per active nest).	Continue to monitor annual nest productivity.
MINERALS AND GEOLOGY		
Establish an oil and gas working group	A workgroup to specifically address management of oil and gas resources and infrastructure on the ANF has not been developed; however, the ANF participated in numerous work/discussion groups related to OGM development.	Continue to participate in work/discussion groups involving OGM development in order to advance learning and stay current on pertinent topics.
Establish and maintain an oil and gas development inventory	Existing OGM-related GIS layers (wells, non-system roads, stone pits) were updated and a new OGM infrastructure (tank batteries,	Continue to update and revise OGM-related GIS datasets using existing resources, including, but not limited to: GPS collected data, aerial photography, LIDAR data, state digitized data, data provided by OGM operators, and ANF digitized data. Where informational gaps still are noted, develop strategies on how best to close these gaps using available resources with implementation driven by priorities.

Description	Results	Recommendations
	compressor stations, building structures, meter stations, and other OGM-related equipment) feature class was created.	
Identify resource concerns associated with oil and gas	3,121 oil/gas well proposals were processed and ANF staff worked with OGM operators, regulatory agencies, and other stakeholders to resolve resource concerns.	Continue to focus resources on responding to emergencies and processing new OGM proposals due to environmental, safety, and legal considerations. Continue to collaborate with operators, regulatory agencies, and other stakeholders to address long-standing concerns when available resources permit – prioritized by the immediacies and magnitudes of the existing environmental, safety, or other land management concerns.
FOREST PEST MANAGEMENT		
Treat acres to increase plant species diversity	Acres treated (Forest Plan objective): 17,459 total, 2,910, annually (3,000-6,200 acres, annually).	Continue monitoring progress toward achievement of desired understory vegetation conditions and the overall health and sustainability of forest ecosystems.
FIRE		
Develop a wildland fire use plan	Due to the low frequency of naturally ignited fires, a fire use plan to manage naturally ignited fires has not been developed.	Developing a wildland fire use plan to manage naturally ignited fires is not applicable to the ANF.
Use prescribed fire and mechanical treatments to reduce hazardous fuels	Hazardous fuel reduction treatments applied (Forest Plan objective): 39,723.5 acres total, 4,543 acres (100-600 acres, annually).	Continue to monitor treatments used to reduce hazardous fuels.

Description	Results	Recommendations
LAND OWNERSHIP		
Acquire subsurface ownership	The ANF worked with partners who expressed interest in conveying mineral rights in special MAs; however, these partners were not able to convey the mineral rights from the subsurface owners.	Continue to work with partners who approach the ANF to discuss options for acquiring mineral rights in MAs 5.1, 5.2, 7.1, 8.1, 8.2, 8.3, 8.4, and 8.5. Talk with interested parties who may be interested in acquiring mineral rights in other areas of the ANF that may have similar site-specific management objectives as the aforementioned MAs.
TRANSPORTATION SYSTEM		
Maintain roads	Road maintenance completed (Forest Plan objective): 379.45 miles of OML 3-5 roads, annually (150 miles, annually) and 107.9 miles of OML 1-2 roads, annually (100 miles, annually).	Continue to monitor road maintenance activities.
Decommission roads no longer needed	Road decommissioning completed (Forest Plan objective): 1 mile, annually (2 miles, annually).	When identifying roads for potential decommissioning during project-level planning, coordinate with other resources, adjacent landowners, and oil and gas operators to determine their need for the roads.
Surface roads with limestone	Limestone road surfacing completed (Forest Plan objective): 7.7 miles, annually (5 miles, annually).	Continue to monitor road miles of surfacings.

Description	Results	Recommendations
Strategic Monitoring Information		
NOXIOUS WEEDS		
Effectiveness of non-native invasive plant controls	A combination of manual/mechanical treatments and herbicide use has been effective in eliminating targeted species in treatment areas.	Continue monitoring select locations for year-after treatment effectiveness in terms of resprouts, seed banks, or missed plants. There is a need for at least one seasonal NNIP technician whose sole responsibility is NNIP treatment, as well as a mastication head and tracked piece of equipment.
RECREATION		
Resource damage from equestrian use outside of EUAs	Resource damage continues to be localized and limited to user-defined trails.	Eliminate open (cross-country) riding where unacceptable cultural or natural resource damage occurs, and evaluate whether an area should be designated as an EUA. Encourage riding on the 38-mile Spring Creek horse trail with proper signing and working with local riding clubs and user groups.
VEGETATION		
Structural and compositional characteristics within stands and at the landscape scale	Initial limited results indicate group selection that incorporates 2007 Forest Plan design criteria for larger group opening sizes appears to be more effective in regenerating stands to a diversity of tree species and shade tolerance ranges than single tree selection treatments or those that utilize smaller group openings.	All single-tree selection harvests completed within the last 15 years should receive an updated seedling stocking survey using current protocols to evaluate seedling establishment success, as part of a continued monitoring and adaptive management approach. Continue monitoring seedling composition, stocking, cost and time to establish seedlings, species diversity, and overall treatment effectiveness in achieving desired structural and compositional vegetation conditions at various scales in areas managed using uneven-aged regeneration methods, particularly with regards to various group opening sizes used with uneven-aged management.
Forest overstory and understory composition	Non-reserved (managed) lands: American beech, black cherry, red maple, and sweet birch are the	Continue monitoring understory and overstory forest composition across the ANF in actively managed and unmanaged areas using various means, including FIA data.

Description	Results	Recommendations
	most abundant overstory species. American beech and red maple are most abundant in the seedling class. Reserved (unmanaged) lands: black cherry, sugar maple, American beech, red maple, and sweet birch are the most abundant overstory species. American beech and sweet birch are most abundant in the seedling class.	
Changes in forest health	In FY 2013, the ANF experienced significant gypsy moth defoliation and detected EAB and HWA for the first time on the Forest. The BBD complex killing front now covers the entire ANF. National Insect and Disease Forest Risk Assessment predict that oaks, ash species, eastern hemlock, American beech, maples, and pines will	Continue insect and disease detection and monitoring activity as a cooperative effort with FHP. Maintain health of forest stands through integrated pest management strategies. Enhance the diversity of forest vegetation in terms of composition and structure in order to improve resiliency of the forest and reduce the level of impact from insects and diseases, particularly those that are introduced. For those insects and diseases that present new threats to Forest tree species (such as EAB, HWA, and SWW), continue monitoring for their presence on the ANF and develop and implement strategies and action plans for these pests that integrate newly identified or state-of-the-art pest control techniques. Continue monitoring overall health and status of affected tree species.

Description	Results	Recommendations
	experience substantial loss of basal area in the next 15 years due to exotic insects and disease introductions.	
Effectiveness of herbicide design criteria	Instances of insufficient buffers along water features were relatively few and have been declining. Requirements for larger buffer widths within the 13% Area were overlooked and did not meet Forest Plan guidelines.	Continue monitoring representative samples of herbicide treatment areas. Continue to ensure personnel laying out herbicide treatment boundaries and surveying sites for water or other sensitive features pay particular attention to less obvious water features that are dry at the time of treatment. Continue to provide training, if necessary, for contract inspectors in the identification and delineation of intermittent streams. Strive to lay out smooth treatment area boundaries without sharp corners that equipment operators are unable to navigate. Ensure adequate flagging is hung to indicate treatment area and buffer boundaries, particularly where heavy understory vegetation and brush is present. This includes hanging flagging as high as possible, with long streamers where heavy brush exists. Layout personnel should strive to walk unit boundaries prior to vegetation leafing out in order to better see water features, pipelines, and other features that should be avoided during treatment. Layout personnel need to survey for water features that fall within 100' of the treatment area boundary to ensure they are properly buffered even if they fall outside the treatment area boundary. Ensure herbicide contract inspectors document condition of buffered water features at the time of treatment.
WATERSHED AND AIR		
Status of water quality	The majority of streams on the ANF are meeting	Water quality data collected by partners should be stored in the appropriate depository so that it can be used for baseline data.

Description	Results	Recommendations
	state water quality standards. Impairments are most frequently related to acid deposition or acidity from natural sources with less frequent occurrences of impairment due to oil spills, nutrients, or sedimentation.	Continue to monitor conductivity at various sites to identify problems that are occurring from OGD. Treatment facilities for streams impacted by acid deposition should be implemented in additional watersheds and monitored. Address sedimentation problems identified in Elk County on the following streams: Three Mile Run, Crooked Run, Steck Run and Little Otter Run. In addition, sedimentation was observed in the Hunter Creek watershed and the roads in this watershed should be reviewed. Mitigation of roads in the Grunder Run watershed is needed to reduce the sediment loads. The monitoring of sediment loads should continue at Grunder Run and Hedgehog Run as funding permits.
SOILS		
Soil disturbance	Detrimental soil disturbance did not exceed the Regional standard of 15% of an activity area.	Post-harvest soil monitoring should continue to ensure that the amount of disturbed areas is minimized to reduce soil compaction. Soil monitoring should occur in stands on each District.
WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT		
Bald eagle conservation measures	Conservation measures were implemented when applicable and management activities did not occur in suitable nesting, foraging, and roosting habitat within buffers established around active nests.	Continue to monitor the implementation of eagle conservation measures. Publish a news releases advising Forest visitors not to disturb eagles and asking them to pick up discarded fishing line. Given it has been five years since the bald eagle was delisted, discuss with USFWS if and how management guidelines identified in the BGEPA differ from the conservation measures already implemented.
Indiana bat conservation measures	Snag and live tree retention conservation measures were not met	Continue to implement conservation measure with emphasis on retaining snags > 10" dbh and live trees ≥ 20" dbh. Retaining trees that may become snags during the first entry (partial harvest) may result in more snags available for retention in the final

Description	Results	Recommendations
	in most stands, although reserve areas were not tallied. All other conservation measures were implemented when appropriate.	harvest. Complete snag longevity study. Discuss with USFWS the overlap of existing conservation measures for Indiana bat and those recommended for the northern long-eared bat (proposed for listing as endangered by USFWS).
Indiana bat status	No Indiana bats were captured during FY 2010 or FY 2013 mist net surveys.	Continue mist net surveys every third year until otherwise coordinated with USFWS. Discuss with USFWS the implications of the revised Indiana bat range in Pennsylvania as well as the overlap of existing conservation measures for Indiana bat and those recommended for the northern long-eared bat (proposed for listing as endangered by USFWS).
Clubshell and northern riffleshell mussel conservation measures	When applicable, conservation measures were implemented with the exception of herbicide buffers in the 13% Area.	The Forest should improve its current system of tracking the status of OGD in the 13% Area after a Notice To Proceed is issued. Sediment load and yield monitoring should resume in Grunder Run and Hedgehog Run. Discuss with USFWS: • The slight increase in zebra mussel introduction risk; • That the conservation measures that would apply to private oil and gas are not applicable; and • The listing of the rayed bean (endangered), sheepnose (endangered), snuffbox (endangered), and rabbitsfoot (threatened) as they are either documented within the proclamation boundary of the ANF or have suitable habitat present.
High quality remote, interior, and late structural/old growth habitat	The acreage and number of high quality remote habitat areas has been maintained, late structural habitat has increased, and old-growth habitat has decreased since the start of Forest Plan	Continue to analyze habitat fragmentation affects within project areas and reduce affects by strategically placing activities to maximize travel corridors and sustain quality remote habitat areas.

Description	Results	Recommendations
	implementation.	
Standing and downed woody debris	Standing dead trees of all sizes and stages of decay as well as down coarse woody debris is present in all stand size classes. Snag recruitment is occurring and standing dead trees are persisting as snags for some time.	Continue monitoring abundance of standing dead trees and down woody debris on the using various means, including FIA data.
Understory plant species diversity	Understory species diversity is slowly improving, primarily associated with reduced deer browsing impacts. Due to the persistence of dense low canopy layers and fern carpets on the forest floor, tree seedling diversity has made a slower, but evident recovery as well.	Continue monitoring forest understory vegetation composition and structure using a variety of data sources and partners.
Reduce impacts to plant species with viability concerns	Two stands in the Meads Mill project area had locations of plant species with viability concerns in which timber harvest activities recently took place. A buffer area was established around	Use monitoring results for determining what future actions to take (if any) for the Meads Mill project units to provide suitable habitat for species with viability concerns.

Description	Results	Recommendations
	populations and will be monitored in FY 2014.	
Federally listed plant species conservation measures	No federally listed plants have been documented.	Additional field work is needed to evaluate the Small Whorled Pogonia Habitat Model. Work with USFWS to modify our surveying techniques and protocols given no documentation of small whorled pogonia has resulted from 25 years of surveying.
MINERALS AND GEOLOGY		
Oil and gas developments meeting Forest Plan design criteria	The ANF is not comprehensively tracking to what extent new OGM developments are meeting 2007 Forest Plan design criteria since Notices to Proceed associated with outstanding and reserved mineral development are being evaluated under 1986 Forest Plan standards and guidelines.	The ANF should change the 2007 Forest Plan in a manner that is consistent with the legal cases that have been decided since the Plan was affirmed with instructions.

List of Contributors

Evelyn Ash	Resource Specialist
Curt Bowley	Marienville Ranger District Recreation Specialist
Dave Brinker	Central Regional Ecologist, Maryland Department of Natural Resources
Roosevelt Carter	Bradford Ranger District Soil Scientist
John Cobb	GIS Specialist
Mark Conn	Bradford Ranger District Recreation Specialist
Steve Forry	Marienville Ranger District Forester
Janeal Hedman	Grant Management Specialist, North East Acquisition Team
Andrea Hille	Forest Silviculturist
Chuck Keeports	Forest Hydrologist
Melissa Johnson	Contracting Officer, North East Acquisition Team
Rosilyn Jordan	Budget Officer
Dawn Laybolt	Forest Archeologist
Will McWilliams	Research Forester, NRS
Kathy Mohney	Executive Assistant
April Moore	Bradford Ranger District Ecologist
Randy Morin	Research Forester, NRS
Julie Moyer	Bradford Ranger District Recreation Team Leader
Ralph Perron	Air Quality Specialist
Dan Salm	Forest Engineer
James Seyler	Operations Staff Officer
Collin Shephard	Forest Ecologist
Scott Stoleson	Research Wildlife Biologist, NRS
Susan Stout	Research Project Leader, NRS

Scott Tepke	Marienville Ranger District Forester
Pamela Thurston	Forest Wildlife Biologist
Pete To	Forest Fire Management Officer
Brad Turberville	Bradford Ranger District Silviculture Team Leader
Rick Turcotte	Entomologist, FHP
Paul Weese	Oil, Gas, and Minerals Program Manager
Nathan Welker	Aquatic Ecologist
Linda White	Marienville Ranger District Recreation Team Leader
Terry Witzel	Marienville Ranger District Forester

List of Acronyms

ALB	Asian longhorned beetle
ANF	Allegheny National Forest
APHIS	USDA-Animal and Plant Health Inspection Service
ARRA	American Recovery and Reinvestment Act
ASQ	allowable sale quantity
BA	Biological Assessment
BBD	beech bark disease
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
CAGP	Central Appalachian Goshawk Project
CASTNET	Clean Air Status and Trends NETwork
CUA	concentrated use area
DASM	digital aerial sketch mapping
dbh	diameter at breast height
DSA	driving surface aggregate
EAB	emerald ash borer
ECCD	Elk County Conservation District
EFETAC	Eastern Forest Environmental Threats Assessment Center
FACTS	Forest Service Activity Tracking System
FCI	Federal Correctional Institute
FDM	Forest Disturbance Mapper
FEIS	Final Environmental Impact Statement
FHM	Forest Health Monitoring
FHP	USDA-Forest Service Northeastern Area, State and Private Forestry, Forest Health Protection
FIA	Forest Inventory and Analysis
FR	Forest Road
FSH	Forest Service Handbook
FSM	Forest Service Manual
FS Veg	Field Sampled Vegetation
FTC	forest tent caterpillar
FWW	fall webworm

FY	fiscal year
GIS	Geographic Information System
GPS	Global Positioning System
HWA	hemlock woolly adelgid
IFTU	Iron Furnace Chapter of Trout Unlimited
KEF	Kane Experimental Forest
KQDC	Kinzua Quality Deer Cooperative
MA	Management Area
MCCD	McKean County Conservation District
MDN	Mercury Deposition Network
msl	mean sea level
MODIS	moderate resolution imaging spectroradiometer
NAAQS	National Ambient Air Quality Standard
NADP	National Atmospheric Deposition Program/National Trends Network
NDVI	normalized differential vegetation index
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NNIP	non-native invasive plants
NNIS	non-native invasive species
NRIS-TESP	Natural Resource Information System-Threatened, Endangered, and Sensitive Plants
NRS	USDA-Forest Service Northern Research Station
OGD	oil and gas development
OGM	oil, gas, and minerals
OHV	off-highway vehicle
p.	page
pp.	pages
PADCNR	Department of Conservation and Natural Resources
PADCNR-BOF	Pennsylvania Department of Conservation and Natural Resources-Bureau of Forestry
PEC	Pennsylvania Equine Council
PFBC	Pennsylvania Fish and Boat Commission

PDA	Pennsylvania Department of Agriculture
PDSI	Palmer Drought Stress Index
PGC	Pennsylvania Game Commission
RAR	Roads Accomplishment Report
ROW	right-of-way
RTFD	Real Time Forest Disturbance
SCA	Student Conservation Association
SEIS	Supplemental Environmental Impact Statement
SWW	sirex woodwasp
TCD	thousand canker disease
TEIS	Transitional Environmental Impact Statement
TIM	Timber Information Manager
TNC	The Nature Conservancy
TU	Trout Unlimited
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
YCC	Youth Conservation Corps
WCCD	Warren County Conservation District
WPC	Western Pennsylvania Conservancy

References

Bonfardine, K. 2014. Unpublished data. *Elk County acid precipitation and physical habitat study*.

Brinker, D. F. 2010. Northern goshawk. In: Ellison, W.G. (ed.). *Second atlas of the breeding birds of Maryland and the District of Columbia.* Baltimore, MD: The Johns Hopkins University Press. Pp. 110-111.

Brinker, D. F. 2012. Northern goshawk. In: Wilson, A.M., D. W. Brauning, and R. S. Mulvihill (eds.). *Second atlas of breeding birds in Pennsylvania*. University Park, PA: The Pennsylvania State University Press. Pp. 148-149.

Brinker, D. F. 2013a. Unpublished data. *Central Appalachian Goshawk Project – 2013 Summary*.

Brinker, D. F. 2013b. Unpublished data. *Proposal to the Pennsylvania Game Commission: Video monitoring of nesting northern goshawks (Accipiter gentilis) in the Central Appalachians*.

Brose, P.H., K.W. Gottschalk, S.B. Horsley, P.D. Knopp, J.N. Kochenderfer, B.J. McGuinness, G.W. Miller, T.E. Ristau, S.H. Stoleson, and S.L. Stout. 2008. *Prescribing regeneration treatments for mixed-oak forests in the Mid-Atlantic region*. GTR-NRS-33. Newtown Square, PA: USDA Forest Service, Northern Research Station. 100 pp.

Buckelew, A. R., Jr. 1991. Recent northern goshawk breeding records from the West Virginia highlands. *Redstart* 58(3): 74–75.

Crocoll, S. 2008. Northern goshawk. In: McGowan, K.J. and K. Corwin (eds). *The second atlas of breeding birds in New York State*. Ithaca, NY: Cornell University Press. Pp. 196–197.

deCalesta, D. S. 2013. Reliability and precision of pellet-group counts for estimating landscape-level deer density. *Human-Wildlife Interactions* 7(1): 60-68.

Federal Land Manager Environmental Database. 2012. Accessed April 1, 2013. http://views.cira.colostate.edu/fed/.

Hand, J.L., S.A. Copeland, D.E. Day, A.M. Dillner, H. Indresand, W.C. Malm, C.E. McDade, C.T. Moore, M.L. Pitchford, B.A. Schichtel, and J.G. Watson. 2011. *Spatial and seasonal patterns and temporal variability of haze and its constituents in the United States: report V.* Accessed December 21, 2012. http://vista.cira.colostate.edu/improve/Publications/Reports/2011/2011.htm

Hanson, J.W. 2014. Unpublished thesis. *Assessing overstory and understory tree species communities and their similarity using data from the Pennsylvania Regeneration Study*. Syracuse, NY: SUNY College of Environmental Science and Forestry. 88pp.

Harris, S. 2011a. Unpublished manuscript. *Biomonitoring of aquatic macroinvertebrates in the Allegheny National Forest in areas of active oil and gas development*. Clarion, PA: Clarion University of Pennsylvania. 164 pp.

Harris, S. 2011b. Unpublished manuscript. *Impacts of sedimentation from oil and gas development on stream macroinvertebrates in two adjacent watersheds of the Allegheny National Forest of northwestern Pennsylvania*. Clarion, PA: Clarion University of Pennsylvania. 141 pp.

Houston, D.R., B.D. Rubin, M.J. Twery, and J.R. Steinman. 2005. Spatial and temporal development of beech bark disease in the northeastern United States. In: Evans, C.A., J.A. Lucas, and M.J. Twery. *Beech bark disease: proceedings of the beech bark disease symposium*. GTR-NE-331. Newtown Square, PA: USDA Forest Service, Northern Research Station. 149 pp.

Kimmel, J.T. and R.H. Yahner. 1994. *The northern goshawk in Pennsylvania: Habitat use, survey protocols, and status*. University Park, PA: The Pennsylvania State University Press. 466 pp.

Krist, F.J., Jr., J.R. Ellenwood, M.E. Woods, A.J. McMahan, J.P. Cowardin, D.E. Ryerson, F.J. Sapio, M.O. Zweifler, and S.A. Romero. 2014. *2013 – 2027 National Insect and Disease Forest Risk Assessment*. FHTET-14-01. Fort Collins, CO: USDA Forest Service, Forest Health Technology Enterprise Team. 199 pp.

Leung,Y.-F., J.L. Marion and S.K. Nepal. 2006. Monitoring trail conditions: new methodological considerations. *The George Wright Forum* 23(2): 36-49.

Marasco, T. and P. Weiss. PADCNR-BOF, Division of Forest Pest Management. PowerPoint Presentation: *DCNR Hemlock Management Strategy, BOF Forest Pest Management and BSP Resource Management*. Clarion, PA. January 28, 2013.

Marquis, D.A., ed. 1994. *Quantitative silviculture for hardwood forests of the Alleghenies*. GTR-NE-183. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station. 376 pp.

NADP. 2013. National Atmospheric Deposition Program NADP/NTN Monitoring Location PA29. Accessed June 10, 2014. http://nadp.sws.uiuc.edu/sites/siteinfo.asp?id=PA29&net=NTN

NatureServe. 2014. NatureServe Explorer: An online encyclopedia of life. Version 7.1. Arlington, VA: NatureServe. Accessed May 30, 2014. http://explorer.natureserve.org

PADCNR-BOF, Division of Forest Pest Management. 2008. *Pennsylvania Annual Pest Conditions Report*. Accessed June 12, 2014. http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_005535.pdf

PADCNR-BOF, Division of Forest Pest Management. 2009. *Forest Insect and Disease Conditions in Pennsylvania*. Accessed June 12, 2014. http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_005536.pdf

PADCNR-BOF, Division of Forest Pest Management. 2010. *Pennsylvania Forest Health Report*. Accessed June 12, 2014. http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_005537.pdf

PADCNR-BOF, Division of Forest Pest Management. 2011. *Pennsylvania Forest Health Report*. Accessed June 12, 2014. http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_009463.pdf

PADCNR-BOF, Division of Forest Pest Management. 2012. *Pennsylvania Forest Health Report*. Accessed June 12, 2014. http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20026259.pdf

PADEP. 2009a. *An evaluation of the Pennsylvania Air Quality Program.* Accessed April 17, 2012. http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/attain/APCA%205-Year%20Report%20042209.pdf

PADEP. 2009b. *Aquatic biology investigation/crude oil spill: Chappel Fork Watershed Survey (SC 56544).* 18 pp.

PADEP. 2011. *Aquatic biology investigation/crude oil spill: Chappel Fork Watershed Survey (SC 56544).* 9 pp.

PADEP. 2013a. *Instream Comprehensive Evaluation Surveys.* Harrisburg, PA: PADEP, Bureau of Point and Non-Point Source Management. 71 pp.

PADEP. 2013b. *Aquatic Biology Investigation-Acidification Study*. Meadville, PA: PADEP, Northwest Regional Office. 25 pp.

Pekney, N., G. Veloski, M. Reeder, J. Tamilia, E. Rupp, and A. Wetzel. 2014. *Measurement of atmospheric pollutants associated with oil and natural gas exploration and production activity in Pennsylvania's Allegheny National Forest*. Journal of the Air & Waste Management Association. *In press.*

Romme, R., K. Tyrell, and V. Brack, Jr. 1995. Unpublished report. *Literature summary and habitat suitability index model: components of summer habitat for the Indiana bat (Myotis sodalis*). Bloomington, IN: Indiana Department of Natural Resources. 38 pp.

Sams, C.E. 2007. Methylmercury contamination: impacts on aquatic systems and terrestrial species, and insights for abatement. In: Furniss, M., C. Clifton, and K. Ronnenberg (eds). *Advancing the fundamental sciences: proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, October 18-22, 2004*. GTR-PNW-689. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 577 pp.

Smith, G.C., J.W. Coulston, and B.M. O'Connell. 2008. *Ozone bioindicators and forest health: a guide to the evaluation, analysis, and interpretation of the ozone injury data in the Forest Inventory and Analysis Program.* GTR-NRS-34. Newtown Square, PA: USDA, Forest Service, Northern Research Station. 100 pp.

Smith, G.C., R.S. Morin, and G.L. McCaskill. 2012. *Ozone Injury to Forests across the Northeast and North Central United States, 1994-2010*. GTR-NRS-103. Newtown Square, PA: USDA, Forest Service, Northern Research Station. 46 pp.

USDA-Forest Service. 1993. *Allegheny National Forest 1986 Land and Resource Management Plan*. Warren, PA: USDA, Forest Service, Allegheny National Forest. 405 pp.

USDA-Forest Service. 1993. *Allegheny National Forest Monitoring and Evaluation Report-Fiscal Year 1992*. Warren, PA: USDA, Forest Service, Allegheny National Forest. 69 pp.

USDA-Forest Service. 1997. *Allegheny National Forest Final Environmental Impact Statement for Vegetation Management Electric Utility Rights-of-way*. Warren, PA: Environmental Consultants Incorporated. 178 pp.

USDA-Forest Service. 2003. *Forest-wide Roads Analysis Report.* Warren, PA: USDA, Forest Service, Allegheny National Forest. 173 pp.

USDA-Forest Service. 2007a. *Allegheny National Forest 2007 Land and Resource Management Plan*. Warren, PA: USDA, Forest Service, Allegheny National Forest. 269 pp.

USDA-Forest Service. 2007b. *Final Environmental Impact Statement to Accompany the Allegheny National Forest 2007 Land and Resource Management Plan*. Warren, PA: USDA, Forest Service, Allegheny National Forest. 708 pp.

USDA-Forest Service. 2008a. *Allegheny National Forest FY 2008 Monitoring & Evaluation Report*. Warren, PA: USDA, Forest Service, Allegheny National Forest. 86 pp.

USDA-Forest Service. 2008b. *Threatened, endangered, and sensitive plants element occurrence field guide*. Washington D.C.: USDA, Forest Service, Rangeland Management Staff. 49 pp.

USDA-Forest Service. 2009. Forest Service Handbook, Allegheny National Forest 2409.17-Silvicultural Practices, Chapter 2-Reforestation. 12 pp.

USDA-Forest Service. 2010. *Site-specific effects of private oil and gas development on the Allegheny National Forest.* Warren, PA: USDA Forest Service, Allegheny National Forest. 96 pp.

USDA-Forest Service. 2012. Forest Service Manual 2500, Eastern Region (R9) Chapter 2550. 6pp.

USDA-Forest Service. 2013. *Allegheny National Forest Monitoring and Evaluation Report-Fiscal Year 2008*. Warren, PA: USDA Forest Service, Allegheny National Forest. 86 pp.

USDA-Forest Service. 2014a. *USDA Forest Service National Forest System data recording protocols and requirements for invasive species: survey, inventory, and treatment*. Washington, D.C.: USDA, Forest Service, Natural Resource Manager. 50 pp.

USDA-Forest Service. 2014b. *Wilderness Stewardship Challenge: Air Quality Values Monitoring Plan*. Warren, PA: USDA Forest Service, Allegheny National Forest. 34 pp.

USDI-Fish and Wildlife Service. 2007. *United States Fish and Wildlife Service concurrence letter regarding determinations in the Revised Forest Plan Biological Assessment*. 21 pp.

USEPA. 2013a. Clean Air Markets Division Clean Air Status and Trends Network (CASTNET). Accessed June 10, 2014. http://epa.gov/castnet/javaweb/index.html

USEPA. 2013b. National Ambient Air Quality Standards (NAAQS). Accessed February 19, 2014. http://www.epa.gov/air/criteria.html

USEPA. 2013c. Standard Nonattainment Areas, Green Book. Accessed November 18, 2013. http://www.epa.gov/airquality/greenbk/hncs.html#PENNSYLVANIA

USEPA. 2014a. Clean Air Markets Division Clean Air Status and Trends Network (CASTNET). Accessed June 10, 2014. http://www.epa.gov/castnet/javaweb/charts/KEF112_pcts.png

USEPA. 2014b. Sulfur Dioxide. Accessed February 20, 2014. http://epa.gov/airquality/sulfurdioxide/

USGPO. 2013. Federal Register Volume 78, Number 150. Accessed February 19, 2014. http://www.gpo.gov/fdsys/pkg/FR-2013-08-05/html/2013-18835.htm

Wilson, A.M., D. W. Brauning, and R. S. Mulvihill (eds.). *Second atlas of breeding birds in Pennsylvania*. University Park, PA: The Pennsylvania State University Press. 586 pp.

Personal communication

Koch, Jennifer. 2013. USDA-Forest Service, NRS. Telephone conversation regarding potentially resistant American beech trees on the ANF.

McWilliams, Will. 2014. USDA-Forest Service, FIA. Email regarding FIA sampling conducted in FY 2013.

Morin, Randy. 2014. Email and telephone conversations regarding FY 2008-2012 FIA data summaries for the ANF.

Pulket, Molly. 2013. PADEP. Excel spreadsheet of PADEP macroinvertebrate data and station information.

Reilly, Rose. 2014. USACE. Email regarding aquatic invertebrate collections from tributaries to the Allegheny Reservoir and River.

Turner, Melinda. 2014. USFWS. Email regarding revised Indiana bat range in Pennsylvania.