

# Engaging Youth Leaders at the Flight 93 National Memorial Reforestation Events *2015-2017*





## Mission

Green Forests Work's (GFW) mission is to re-establish healthy and productive forests on formerly mined lands in Appalachia.

## Vision

GFW's vision is to create a renewable and sustainable multi-use resource that will provide economic opportunities while enhancing the local and global environment by converting reclaimed, non-native grasslands and scrublands into healthy, productive forestland.

Our reforestation projects provide jobs for equipment operators, nursery workers, and tree planters, and improve the environment by eradicating exotic species and restoring ecosystem services. With the help of our partners and volunteers, this vision is quickly becoming a reality...

**Since 2009, we have planted more than two million trees  
on more than 3,200 acres,  
but there are nearly one million acres left to reforest.**

Michael French

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Twenty year old research plots on a surface mine in Breathitt County Kentucky show how the Forestry Reclamation Approach allows native forests to be re-established after reclamation.

Front Cover: A planting bucket and planting bar at a reforestation site offering a view of the Memorial.

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# BACKGROUND

The Flight 93 National Memorial was created to commemorate the 40 passengers and crew members of United Airlines Flight 93, who courageously gave their lives to save others during the terrorist attacks on September 11, 2001. Passengers and the crew of Flight 93 forced the terrorists to crash the plane on a reclaimed surface mine near Shanksville, Pennsylvania, thwarting an attack on our nation's capital. In 2011, the National Park Service asked the US Department of the Interior - Office of Surface Mining Reclamation and Enforcement (OSMRE) to assist with reforesting the reclaimed mine land surrounding what is now the Flight 93 National Memorial. Since then, the Appalachian Regional Reforestation Initiative (ARRI) of OSMRE and Green Forests Work have provided technical and financial assistance to annual reforestation projects and have helped organize and direct volunteer tree planting events each spring. Technical assistance was provided for site preparation, which included soil de-compaction using a large bulldozer pulling 3-foot long ripping shanks through the soil on an 8-foot spacing in perpendicular directions. To date, reforestation has occurred on nearly 140 acres across six different sites (Figure 1). Approximately 3,000 volunteers have planted more than 102,000 seedlings, including The American Chestnut Foundation's potentially blight-resistant American chestnuts and the Forest Service's Dutch Elm Disease-resistant American elms (Table 1). Other tree species planted mimic the white pine—red oak—red maple cover type that would naturally occur at this site. More than 30 native species of tree seedlings have been used so far, all common to this cover type.

In 2015, GFW was awarded a grant provided by the OSMRE that was administered by the National Fish and Wildlife Foundation. The grant supported the Secretary of the Department of the Interior's 'Engaging the Next Generation Youth Initiative' and the spirit of volunteerism across the US. The grant from OSMRE provided hands-on, educational field experiences for college students to be involved in the planting events from 2015-2017 and to establish permanent monitoring plots and perform an initial assessment of seedlings planted from 2012-2015. This report focuses on those experiences and the results of the monitoring assessment.



*GFW president, Dr. Chris Barton, stands next to a four-year-old eastern hemlock planted at the 2013 site that was grown from the seed of a tree on the Gettysburg battlefield.*

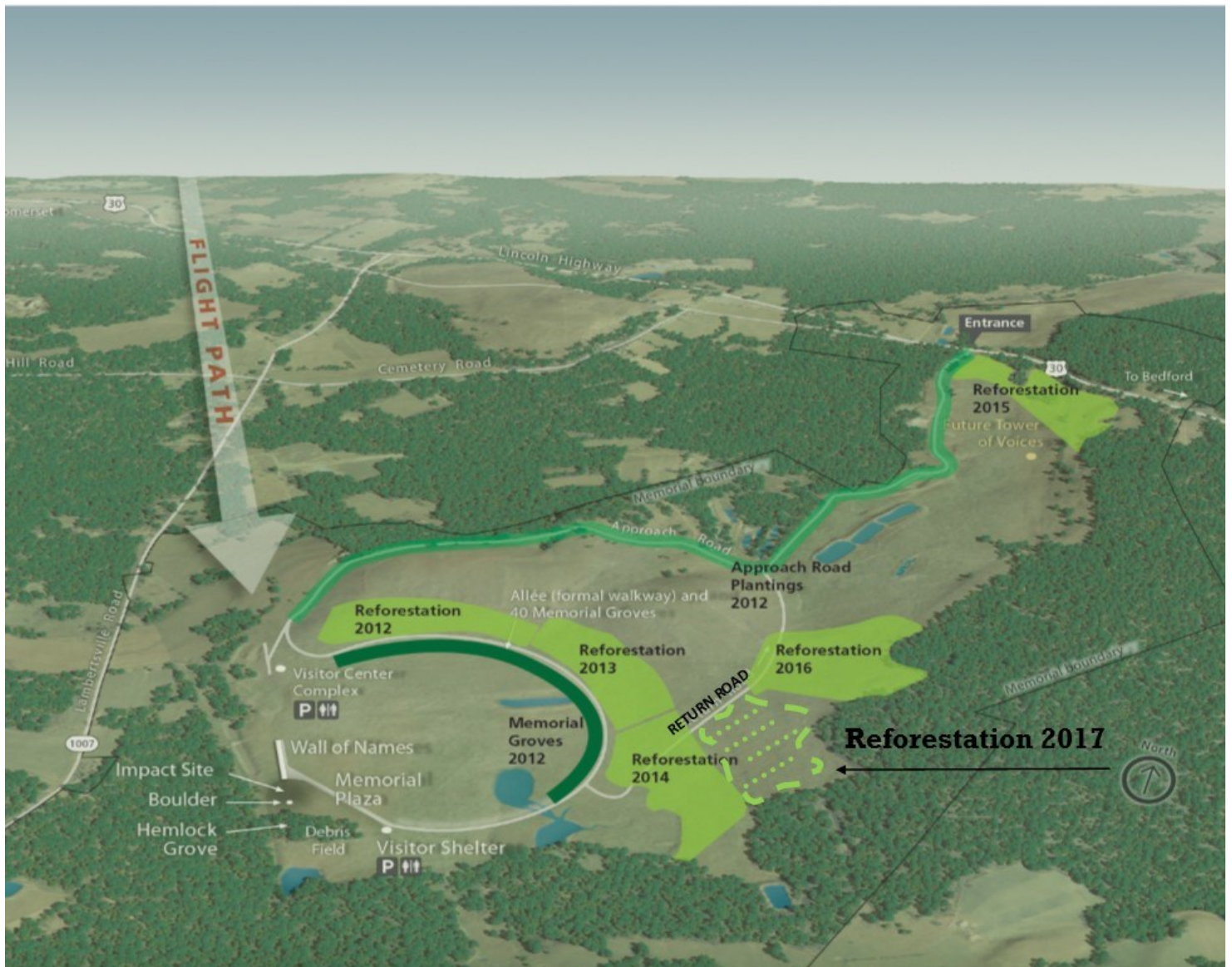


Figure 1. Map of the Flight 93 National Memorial reforestation sites. Figure Source: National Park Service: <https://www.nps.gov/flni/planyourvisit/planttreesflni.htm>

Year Planted	Acres Planted	No. of Trees	No. of Participants
2012	19	14,369	500+
2013	23	17,300	500+
2014	28	20,550	400+
2015	28	22,000	400+
2016	23	16,635	400+
2017	17	11,600	400+
<b>TOTAL</b>	<b>138</b>	<b>102,393</b>	<b>~2,600</b>

Table 1. Annual summary of reforestation events.



# STUDENT ACTIVITIES

## Planting Event Preparation

The students helped prepare the planting buckets prior to the volunteer planting events. This process entails dividing large bags of seedlings (100-500 seedlings) into the correct amount for each bucket, based on a planting prescription. After the seedlings are sorted, they are dipped in solution that helps the trees' roots retain moisture and placed into buckets filled with a soil medium that also helps protect the seedlings' roots. Students were involved in every step of the process and learned about the species planted along the way. Students also learned ways to identify the viability of a seedling and how to properly prune the roots if they are too cumbersome to plant. Other topics such as proper planting techniques were discussed. This hands-on, learning activity gave students the information they needed to be confident leaders in the field, so they could answer other volunteers' questions and provide assistance.



*Students from Pennsylvania sort seedlings for 2016 planting event.*



*Seedling roots after being dipped in a solution that helps them retain moisture.*



*Divided seedlings ready to be placed in buckets.*



## Tree Planting

The students also participated in a planting event. The students were paired with other planters outside their group, which included project partners and victims' family members. By partnering with other people at the event, the students were able to network and enhance their experience.

*"I volunteered for the flight 93 tree planting because the crash and events on that day are some of the most important historical events in our history. I am so happy with the experience I received from planting trees with people from all over with different stories. A woman who lost her husband on the flight, and a woman who was friends with someone on the flight, were in my group.*

*Knowing that the planting we participated in helped the families and friends of flight 93 cope with their losses was such an amazing experience, and I cannot wait to go back next year and do all the hard work again."*

*-Penn State DuBois student, 2015*



University of Kentucky student partners with a member of the US Forest Service to plant trees.



University of Kentucky student plants a seedling with GFW's Director of Operations.



University of Kentucky student partners with a member of the US Forest Service to plant trees.



# MONITORING

In the summer of 2015, biology students from Indiana University of Pennsylvania, working under the direction of Dr. Michael Tyree, were paid to collect monitoring data on the 2012-2015 reforestation sites. Monitoring objectives included the following:

- 1) Determine survival and establishment success of each woody species and major plant groups planted each year.
- 2) Evaluate level of deer browse for each species for each year.
- 3) Describe competing vegetation across each year.
- 4) Test whether planting position impacts plant growth.

To achieve these objectives, students collected data on species, height, ground-line diameter, vigor class, deer browse, and planting location for each woody plant within a permanent, fixed-radius plot and percent cover and competing vegetation was determined for four subplots within each permanent plot. For a detailed explanation of monitoring methodology, see *The Flight 93 National Memorial Reforestation Monitoring Project Summer 2015* final report.



Students from IUP collecting monitoring data.

Photo from <http://www.iup.edu/news-item.aspx?id=201760>



## HISTORY OF MINED LAND REFORESTATION PROCEDURE

Surface mining in Appalachia has replaced approximately one million acres of eastern deciduous forest, one the most diverse and valuable forests in the world, with primarily non-native grasses and shrubs. Understanding the reasons behind this requires a brief history of mine reclamation, starting with the Surface Mining Control and Reclamation Act (SMCRA) of 1977. This act created the U. S. Office of Surface Mining Reclamation and Enforcement (OSMRE), whose mission was to enforce a new set of reclamation guidelines that would standardize reclamation practices for the mining industry. Prior to SMCRA, some mining operations practiced “shoot ‘n shove” mining, where overburden was “shot” off the coal seam and “shoved” downhill. Revegetation requirements were minimal and varied from state to state, as there was no national standard. The loose piles of overburden could support tree growth, but they were also highly unstable. As a result, large landslides occurred and created a hazard to public safety. SMCRA addressed this issue by requiring more intense grading. The overburden was used to backfill the mined area to achieve the approximate original contour, but the grading led to severe soil compaction. Native hardwood trees could not tolerate the compaction and competition from aggressive groundcovers, so mining operations moved away from forestry reclamation (i.e. planting trees) to establishing hayland/pasture to meet revegetation requirements. Without management, the pastures were quickly (within 10 years) overcome with invasive, exotic species and resided in a state of arrested succession. Researchers foresaw the unintended consequences of SMCRA and began developing a method of reclamation in the 1980s that would allow both stability and tree growth. By 2004, there were numerous scientific studies supporting what became known as the Forestry Reclamation Approach (FRA).

The OSMRE created ARRI in 2004 to coordinate the implementation of the FRA. After making progress with the active mining industry, ARRI members began to look back at the sites reclaimed under SMCRA that led to their establishment, so called “legacy” mines. Experimental re-reclamation of legacy mines by ARRI members revealed the need for increased scale to stimulate the economic development and environmental improvement Appalachia needed, thus the idea of Green Forests Work was born. Further research laid the groundwork for the modified version of the FRA that we use today.





# RESULTS & DISCUSSION

## Student Activities

From 2015-2017, 105 students, representing five different universities, participated in planting event preparations and the tree planting events as part of the grant (Table 2), and 271 youth participated in the plantings. The majority of the student groups were from Pennsylvania, and three of the five schools attended

multiple years. Student testimonials and repeated attendance indicate that the students valued the experience. By participating in these activities, students are introduced to ecological restoration and the many entities that are involved in the work. We believe this is an invaluable networking and leadership opportunity for students, as well as an educational and meaningful experience.

Volunteer Group	2015	2016	2017
Altoona Area High School (PA)			
Indiana University of Pennsylvania			
Pennsylvania State University-Altoona			
Pennsylvania State University-DuBois			
University of Kentucky			
<b>Total Number of Students</b>	<b>42</b>	<b>35</b>	<b>28</b>

Table 2. Volunteer groups and total number of volunteers for each year of activity.



Group photo of Pennsylvania students prior to planting trees at the 2015 planting event



## Monitoring

In the summer of 2015, biology students from Indiana University of Pennsylvania, working under the direction of Dr. Michael Tyree, were paid to collect monitoring data on the 2012-2015 reforestation sites. From 2012-2015, 74,219 trees were planted at the Flight 93 National Memorial. Overall, survival of planted trees and shrubs was above 55% across all four years, however, within individual planting years, survival ranged from 93-36% with survival being the greatest in 2012 and lowest in 2015. Quaking aspen, locust species, and pitch pine consistently performed well across all four years with eastern hemlock, sugar maple, and red maple demonstrating the poorest survival and growth. American chestnut backcrosses showed variable performance across the four years.

For each of the 4,994 woody trees and shrubs that were measured across all sampling plots, deer browse was extremely low with 97% of all seedlings showing no sign of deer browse and only 3% being classified as low impact. Coniferous tree species showed no sign of deer browse and among the deciduous trees, quaking aspen and black gum showed the highest (19% and 18%, respectively).

Within two years, the amount of bare soil was less than 10% of the total area. Herbaceous dicots and grasses/sedges were the earliest competitors to appear occupying approximately 68% of available growing space within the 2015 site, to more than 80% in the 2013 and 2014 sites. The 2012 sites showed a slight decrease (76%) with a corresponding increase in *Rubus* spp. cover (10.3%).

A statistically significant ( $P = 0.006$ ) interaction

between plant group (coniferous, deciduous tree, shrub) and planting location (bottom of rips, middle of rip, or on ripping mounds) was found in both coniferous and deciduous tree species. Average height was greater in plants located on the tops of the ripping mounds relative to the middle or bottom locations, however, there was no effect of planting location on shrub height.

Monitoring of the reforestation efforts will continue in the future. The results of this monitoring will be used to assist decision-making for future reforestation efforts at the Flight 93 National Memorial and for other surface mine reforestation efforts in Pennsylvania.

For a detailed explanation of monitoring results, see *The Flight 93 National Memorial Reforestation Monitoring Project Summer 2015* final report.



