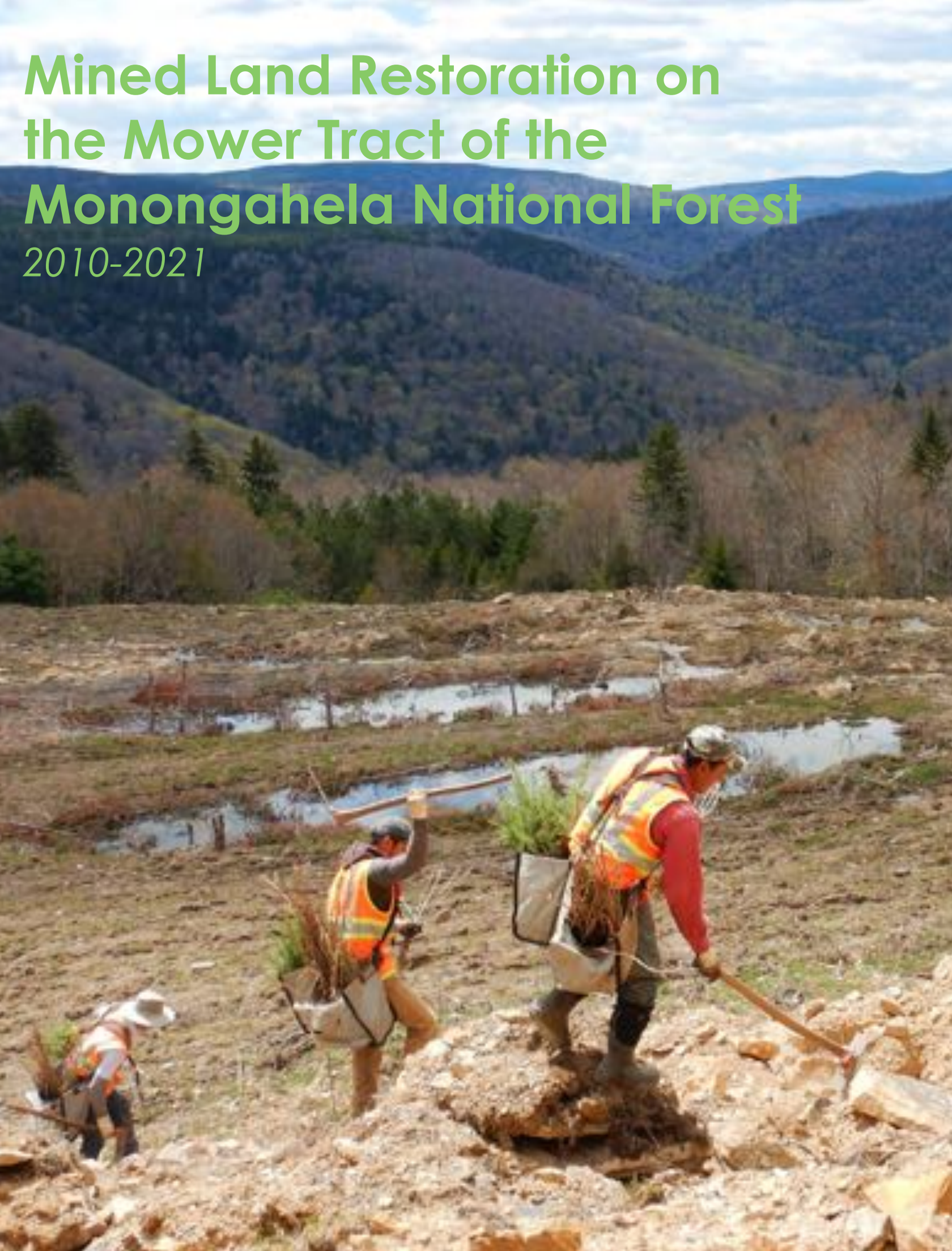
Mined Land Restoration on the Mower Tract of the Monongahela National Forest

2010-2021



MISSION

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

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, GFW has helped plant nearly **4 million trees** across more than **6,200 acres**.

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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: Contract tree planters plant red spruce and native hardwoods on the recently decompacted 2021 restoration area.

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SITE HISTORY & PROJECT GOALS

The Mower Tract (40,000 acres) of the Monongahela National Forest was purchased from the Mower Land and Lumber Company in the early 1980s. It is located on Cheat Mountain (4,848 ft) in Randolph and Pocahontas Counties, West Virginia (Figure 3). The Mower Tract and the surrounding high elevation areas were historically dominated by old-growth red spruce and red spruce-northern hardwood forests; but after the industrial logging era of the late 19th and early 20th centuries, the red spruce ecosystem was reduced from 1.4 million acres to approximately 50,000 acres in the West Virginia highlands. Clear-cut slash ignited unnaturally hot wildfires, which eliminated the red spruce seed source and caused former red spruce forests to be replaced by even-aged, hardwood dominated forests. Extensive logging was linked to regional flooding and was key to the establishment of the Monongahela National Forest.

In addition to logging, coal mining further reduced and prevented the re-establishment of red spruce communities in West Virginia. In the Mower Tract, approximately 2,000 acres were surface mined for coal. Reclamation laws required mining companies to return the site to approximate original contour and to control erosion, which was accomplished by compacting soils and planting non-native trees or seeding aggressive grasses and legumes. The Mower Tract was reclaimed to non-native conifer plantations (Figure 1) and pasture (Figure 2) and remained this way for roughly 40 years. Native species could not recolonize the reclaimed sites because of the compacted soils and thick grass cover.

Starting in 2010, the U.S. Forest Service began a partnership with Green Forests Work (GFW) and the Appalachian Regional Reforestation Initiative (ARRI) to conduct a suite of restoration activities, including non-native species removal, organic matter loading, soil decompaction, mined land reforestation, and wetland creation. In the short term, the goal is to create an early successional habitat, with the ultimate goal being to establish a forest that is at least 30% red spruce. Ancillary benefits include improved water quality, enhanced wildlife habitat, and improved ecosystem services, such as carbon sequestration.

Figure 1. Non-native conifer plantations provide fewer ecosystem services than native forests.

Figure 2. Non-native grasses and soil compaction prevent native species colonization.

RESTORATION BENEFITS

Red Spruce

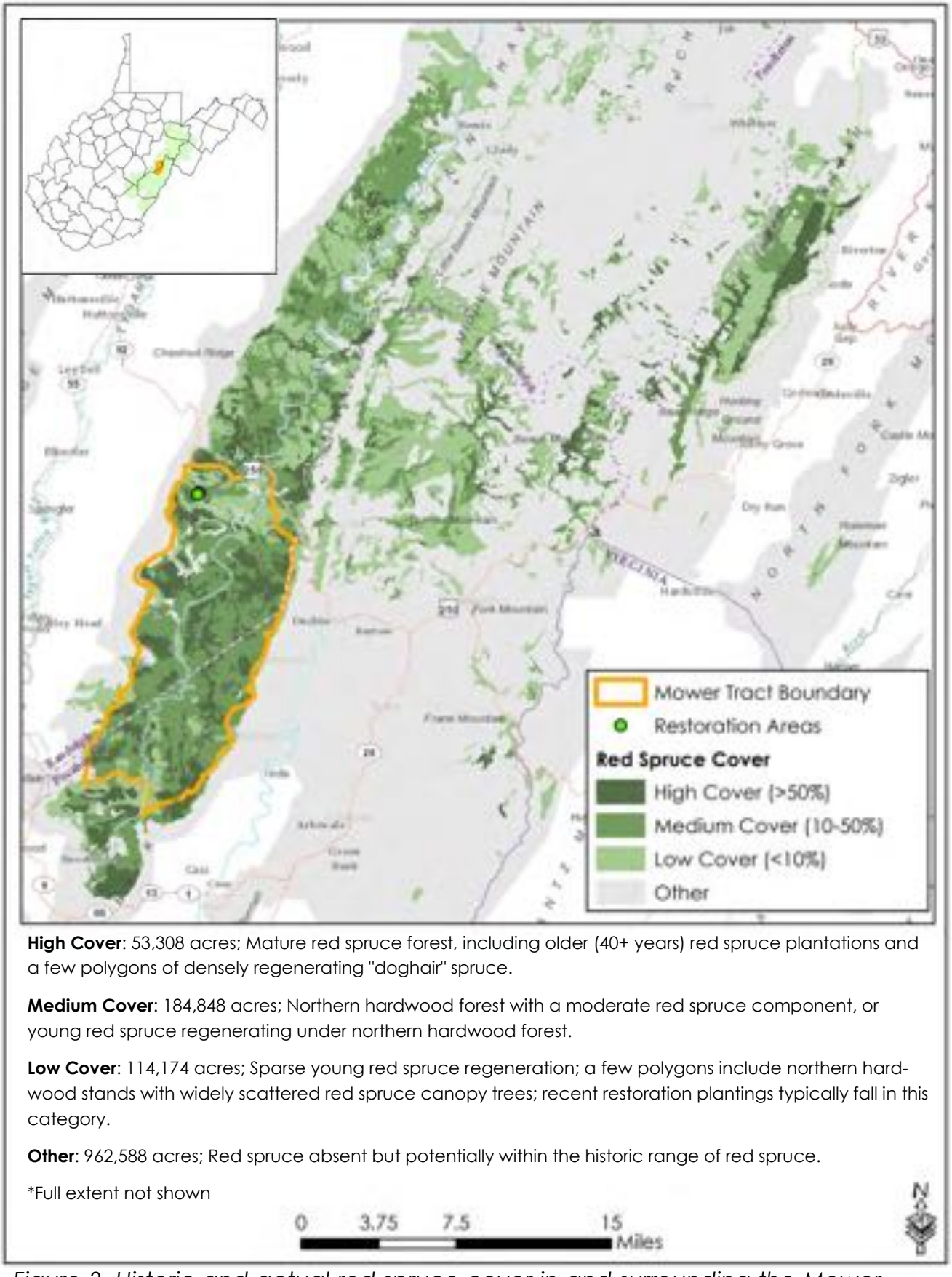
As previously mentioned, red spruce (*Picea rubens*) influenced forests have severely declined in West Virginia: The Red Spruce – Yellow Birch Forest (G2S2) and the Red Spruce – Southern Mountain Cranberry Forest (G2S1), which surrounds the Mower Tract, are imperiled[1] and critically impaired[2] communities within the state, respectively. Protecting and re-establishing these communities is of conservation concern because they support 240 rare species in West Virginia alone (see page 6).

Red spruce have a limited range due to their specific site requirements. They grow best in cool, moist climates, which is why the high elevations of the Appalachian Mountains are one of the few places that can support their growth. Cheat Mountain, where the Mower Tract is located, has been identified by the Central Appalachian Spruce Restoration Initiative and The Nature Conservancy as a key red spruce corridor and top priority for conservation (Figure 3). Corridors connect large communities together, acting as roadways for all the living things within them. Having these connections between large communities allows species to move further north as the southern extent of their range becomes inhospitable due to climate change.

[1] *Imperiled (S2) is a conservation status designated by NatureServe meaning that the species has a high risk of extinction due to restricted range, relatively few populations (80 or fewer), recent or widespread declines, or other factors.*

[2] *Critically imperiled (S1) is a conservation status designated by NatureServe meaning that the species has a very high risk of extinction due to extreme rarity (five or fewer populations), very steep declines, or other factors.*

Newly planted red spruce at the 2018 restoration site.



High Cover: 53,308 acres; Mature red spruce forest, including older (40+ years) red spruce plantations and a few polygons of densely regenerating "doghair" spruce.

Medium Cover: 184,848 acres; Northern hardwood forest with a moderate red spruce component, or young red spruce regenerating under northern hardwood forest.

Low Cover: 114,174 acres; Sparse young red spruce regeneration; a few polygons include northern hardwood stands with widely scattered red spruce canopy trees; recent restoration plantings typically fall in this category.

Other: 962,588 acres; Red spruce absent but potentially within the historic range of red spruce.

*Full extent not shown

Figure 3. Historic and actual red spruce cover in and surrounding the Mower Tract show how the restoration area will help to maintain a migratory corridor.

RESTORATION BENEFITS

Wildlife

Numerous species are dependent on the red spruce ecosystem, several of which are of conservation concern due to the decline of red spruce communities. In West Virginia, 240 rare species are associated with red spruce ecosystems. Most notably and specific to the project site is the Cheat Mountain salamander (*Plethodon nettingi*; G2S2; LT), which is imperiled within the state and is a federally listed endangered species. As its name implies, this salamander's range covers a very small area only in the high elevations of the Allegheny Mountains in West Virginia, where its preferred spruce forest types occur. Similarly, the West Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*; G5T2S2) is also imperiled within the state and only occupies select areas in West Virginia and Virginia because its forage and habitat are strongly associated with the declining spruce-influenced forests. In addition to the decline of red spruce ecosystems, the southern water shrew (*Sorex palustris punctulatus*; G5T3S1) is critically imperiled within the state, likely because of habitat acidification and the warming and siltation of headwater streams (see page 8) due to coal mining.

The restoration work at the Mower Tract will also benefit numerous birds, as more than 80 species of Neotropical migratory songbirds are known to breed in the Tract, and more than 100 others use it as a stopover point during spring and fall migrations. Table 1 provides an overview of a few of the species known to utilize the Mower Tract. Restoration efforts on the Mower Tract will immediately benefit a variety of species, most notably those that use early successional, wetland, and restored mine site habitats. In the long-term, restoration efforts will benefit more than 24 Neotropical migratory songbird species dependent on the red spruce ecosystem, including state-imperiled breeding populations of the Pine Siskin (*Carduelis pinus*; G5S2B) and the Northern Waterthrush (*Seiurus noveboracensis*; G5S2B). The state-imperiled Northern Saw-whet Owl (*Aegolius acadicus*; G5S2B) and seven other state-vulnerable (S3) breeding populations of birds associated with this ecosystem also stand to benefit from restoration. As the forest matures, more secure species such as Appalachian cottontail, snowshoe hare, whitetail deer, black bear, wild turkey, ruffed grouse, and many others will also benefit from restoration efforts.

Ridgewater LLC has been creating wetlands for the last 6 years on the Mower Tract.

A wetland complex created in 2021.

Breeding Birds	
Early Successional Habitat	Mourning Warbler
	Chestnut-sided Warbler
	Canada Warbler
	American Woodcock
Forest Habitat	Magnolia Warbler
	Blackburnian Warbler
	Yellow-rumped Warbler
	Swainson's Thrush
	Veery
	Hermit Thrush
	Rose-breasted Grosbeak
	Northern Saw-whet Owl
Wetlands	Northern Waterthrush
	Alder Flycatcher
	Olive-sided Flycatcher
Reclaimed Mine Sites	Vesper Sparrow
	Savannah Sparrow
Ponds	Hooded Merganser
	Wood Duck
Spring Migrants	
More than 100 species of birds visit the area during spring migration	Blackpoll Warbler
	Tennessee Warbler
	Grey-cheeked Thrush
Fall Migrants	
Raptors	Northern Harrier, Merlin, Peregrine Falcon, Rough-legged Hawk, and Bald Eagle
Waterfowl and Waterbirds	Double-crested Cormorant, Ruddy Duck, Greater Scaup, Lesser Scaup, and American Gadwall
Winter Residents	
	Eastern Golden Eagles
Spruce-dependent	
The Mower Tract was once part of the spruce-influenced spine of the Appalachians. This forest type provides the only large area of habitat for breeding birds of northern affinities in the mid-Atlantic	Northern Goshawk
	Saw-whet Owl
	Canada Warbler
	Yellow-bellied Flycatcher
	Olive-sided Flycatcher
	Blackburnian Warbler
	Red Crossbill
	Northern Waterthrush

Table 1. A few of the bird species known to utilize the Mower Tract and surrounding area.

RESTORATION BENEFITS

Water Quality

Nearly all of the Mower Tract and the restoration areas are located in the First Fork-Shavers Fork watershed (HUC12: 050200040301), which has the highest ranking for watershed biodiversity (B1—outstanding global diversity) according to national standards developed by NatureServe and modified for state implementation by the West Virginia Division of Natural Resources (Figure 4). Therefore, protecting water quality in this watershed is of upmost importance. The majority of the restoration sites drain to Lambert Run, a small tributary of Shavers Fork. The U.S. Army Corps of Engineers identified the abandoned Lambert Run Mine Site (WVAML #3744, strip bench 2) as being a substantial source of sediment to Lambert Run. Sedimentation can impact aquatic life, such as native brook trout (*Salvelinus fontinalis*; G5S5), through habitat burial and can increase the murkiness (turbidity) of the water, reducing light penetration and thus the ability of plants to photosynthesize. This can devastate the base of the food chain for the aquatic ecosystem, which impacts all of the higher level species.

The soil compaction resulting from reclamation laws at the time may have prevented severe erosion (i.e. landslides) on site, but it led to increased sediment erosion. Without a forest canopy to intercept rainfall, raindrops hit the compacted ground with more force and loosen soil particles. Instead of infiltrating into the soil, rainfall travels across the surface as overland flow, carrying the soil particles. Erosion is increased by the fast-moving overland flow and the larger volume of water reaching receiving waters compared to pre-disturbance conditions. Overland flow also has a warmer temperature than water that has infiltrated into the cool soil. Warm water holds less dissolved oxygen than cold water, leaving less oxygen available to aquatic life. Murky water also absorbs more radiant heat from the sun, warming it even more and further reducing dissolved oxygen. By decompacting the soil and increasing soil organic matter, sedimentation will be reduced because rainfall will more readily infiltrate the soil. The developing forest, which will create a thick, organic soil layer, along with newly created wetlands, will help intercept and absorb some of the rainfall and then slowly release it to the watershed.

The establishment of a forest canopy may further improve water quality by decreasing acid-loading of streams through interception of rainfall and evapotranspiration. The First Fork-Shavers Fork watershed has many 303d listed impairments due to pH (Figure 4), so reduced acid loading could improve water chemistry.

Just a few months after constructing wetlands, amphibians begin utilizing them to lay their eggs.

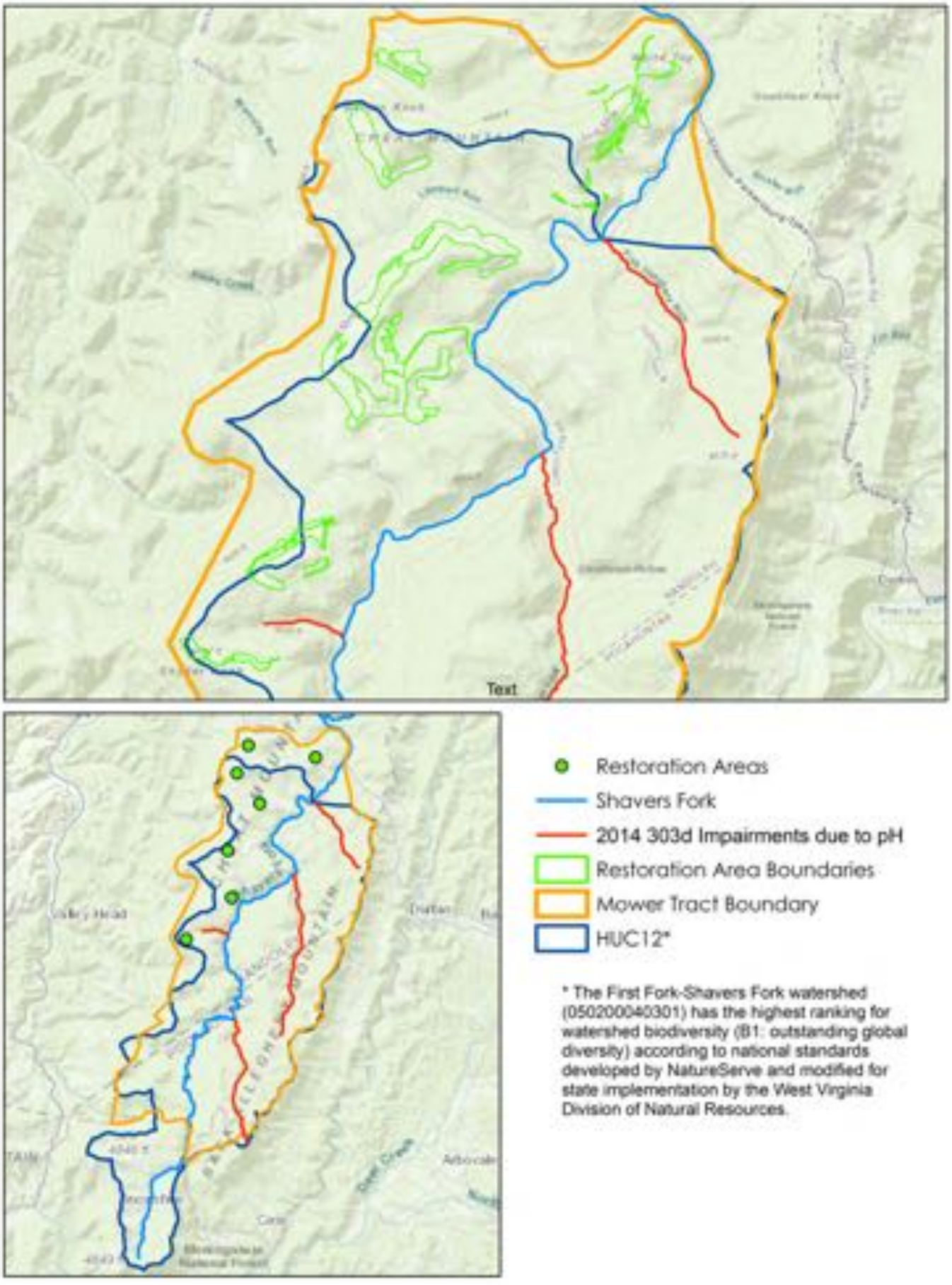


Figure 4. Restoration areas relative to Lambert Run and HUC 12 watersheds.

RESTORATION BENEFITS

Socioeconomic

In addition to providing a multitude of environmental benefits, re-establishing red spruce will also help generate future revenue for the Forest through sustainable timber harvesting. Red spruce is a high-value species because of its use in paper manufacturing and construction. It has added economic and cultural value in the region because it is a preferred material for many stringed instruments that are popular in bluegrass music.

In the short-term, the clearing of the non-native trees opens the viewshed of the Mower Tract to visitors, and in the near future, a more visually interesting landscape will be established. The projected improved aesthetics of the area encouraged the U.S. Forest Service-Monongahela National Forest to establish hiking and biking trails through the restoration sites. These, coupled with the restoration work, will ideally attract more visitors to the area by providing improved opportunities such as bird watching and hunting.

Contract services and supplies for restoration activities such as soil decompaction, tree planting, wetland creation, and cultivation of seedlings have also put millions of dollars back into a region that has experienced a severe economic downturn due to the decline in the coal industry.

Equipment contractors assess wetland creation areas. Non-native pine plantation in background.

In an effort to better understand the effectiveness of our reforestation and wetland creation endeavors, we have undertaken several research projects to examine the utility of these modified landscapes for providing wildlife habitat and restoring ecosystem services. **Michaela Lambert** performed a study to examine amphibian utilization of created wetlands on the Mower Tract. Wetlands created within disturbed landscapes may be an important key to restoring lost ecosystem functions. Reclaimed mines provide an opportunity to create wetlands and restore natural features within a disturbed landscape while benefiting amphibians, a group of animals that has seen global declines due to habitat loss. We sampled 39 of the created wetlands at four ages (2, 4, 6, and 8 years since construction) to: 1) characterize differences in wetland habitat, 2) estimate amphibian occupancy and abundance, and 3) identify wetland characteristics most important for amphibian utilization of wetlands. In the one-year study, we captured over 2,200 amphibians from 8 species including: green frog *(Lithobates clamitans)*, wood frog *(Lithobates sylvaticus)*, American toad *(Anaxyrus americanus)*, gray treefrog *(Hyla versicolor)*, spring peeper *(Pseudacris crucifer)*, spotted salamander *(Ambystoma maculatum)*, eastern newt *(Notophthalmus viridescens)*, and four-toed salamander *(Hemidactylium scutatum)*. Water quality within the wetlands was good, which contrasts with several studies in the region where poor water quality in streams from mining has resulted in low occupancy and abundance of amphibians. Results indicated that, with adequate site preparation, created wetlands on the reforested surface mines provide suitable habitat for pond breeding amphibians.

For more information see: Lambert, M, A.N. Drayer, W. Leuenberger, S.J. Price and C.D. Barton. 2021. Evaluation of created wetlands as amphibian habitat on a reforested surface mine. Ecological Engineering. https://doi.org/10.1016/j.ecoleng.2021.106386

RESEARCH

In another study, **Anna Maria Branduzzi** examined the use of native seed and woody debris to enhance plant biodiversity at the Mower Tract. Increasing plant diversity through direct seeding and repurposing downed woody debris could add valuable habitat components for ecological restoration projects. The study was designed to test the viability of direct seeding native herbaceous and shrub species on recently ripped land. Given the amount of downed woody debris that has been created, we also wanted to examine whether it may benefit direct seeding efforts. Nine native herbaceous and one shrub species were seeded in fall 2018. The ten species were individually seeded in 1 x 1-meter plots and replicated 3 times with and without 5 kg of woody debris. The following species were utilized in the study: tall white beardtongue *(Penstemon digitalis)*, black-eyed Susan *(Rudbeckia hirta)*, butterfly milkweed *(Asclepias tuberosa)*, evening primrose *(Oenothera biennis)*, purple node Joe pye weed *(Eupatorium purpureum)*, common milkweed *(Asclepias syriaca)*, New York ironweed *(Vernonia noveboracensis)*, showy ticktrefoil *(Desmodium canadense)*, staghorn sumac *(Rhus typhina)*, and whorled rosinweed *(Silphium trifoliatum)*. Results from the study found that all native seed species examined were able to germinate in the mine soil and 90% of the species survived through the first growing season. Survival rates were good with half of the species exhibiting rates above 75%. The percent cover of the seeded plots, on the other hand, was relatively low and will need to be reexamined in future years. The addition of woody debris showed mixed results with a slight decrease in germination, but a 14.5 percentage point increase in growing season survival. The positive influence of woody debris on plant survival overall, in addition to the numerous other benefits to ecosystem restoration, may encourage mine restoration practitioners to retain wood on-site for restoration purposes.

For more information see: Branduzzi, Anna Maria, "ENHANCING NATIVE PLANT DIVERSITY ON LEGACY MINELANDS" (2020). Theses and Dissertations--Forestry and Natural Resources. 59. https://uknowledge.uky.edu/forestry_etds/59

Research in progress by graduate students at the University of Kentucky:

Breezey Snyder (left) is studying bat foraging around constructed wetlands and determining the quantity of insects, as bat food, at these Mower Tract sites. Last year, Breezey was a Forester with GFW, and before that she was employed by The Nature Conservancy in West Virginia. Funding from the Office of Surface Mining Reclamation and Enforcement's Applied Science Program will provide an opportunity to expand this research to include birds, amphibians, and mammal monitoring.

Ben Rhodes (right) is studying the performance of red spruce planted in various site conditions across the high elevations of WV. His goal is to determine what locations are optimal for red spruce restoration, and his study sites include the Mower Tract restoration site and nearby unused pastures. Ben formerly worked for The Nature Conservancy in West Virginia.

RESTORATION ACTIVITIES

Since Green Forests Work began working with the U.S. Forest Service-Monongahela National Forest and other partners, restoration projects have taken place nearly annually on the Mower Tract (Figure 5). Prior to planting, non-native species were removed and the soil was decompacted. In total, 1,113 acres have been restored. This has included the creation of more than 1,460 wetlands and the planting of over 560,000 trees and shrubs (Table 2). Although the majority of the planting has been accomplished by professionals, more than 500 volunteers have assisted us in these efforts. The following sections provide information on each step of the restoration process. Green Forests Work's mined land restoration procedure is based on a modified version of the Appalachian Regional Reforestation Initiative's Forestry Reclamation Approach.

Year Planted	Restoration Area (ac)	# Trees and Shrubs Planted	# Species Planted	Wetlands Created	Volunteers Engaged
2011	90	22,550	12	135	60
2013-2014	105	28,485	8	75	117
2015	116	46,937	11	279	49
2016	65	35,436	22	100	90
2017	95	76,782	32	318	90
2018	200	93,308	35	175	14
2019	58	51,108	23	192	85
2020	200 [1]	92,318	21	84	0
2021	184	119,718	32	108	20
TOTAL	1,113	566,642	60 [2]	1,466	525

Table 2. Yearly summary of restoration activities.

[1] In addition to the 192 ripped acres, 8 acres of nonripped slopes were planted.
[2] There is overlap in the species planted each year. Across all years, a total of 60 different species have been planted.

Red spruce for this project are grown from locally collected seed. Photo courtesy of Dave Saville.

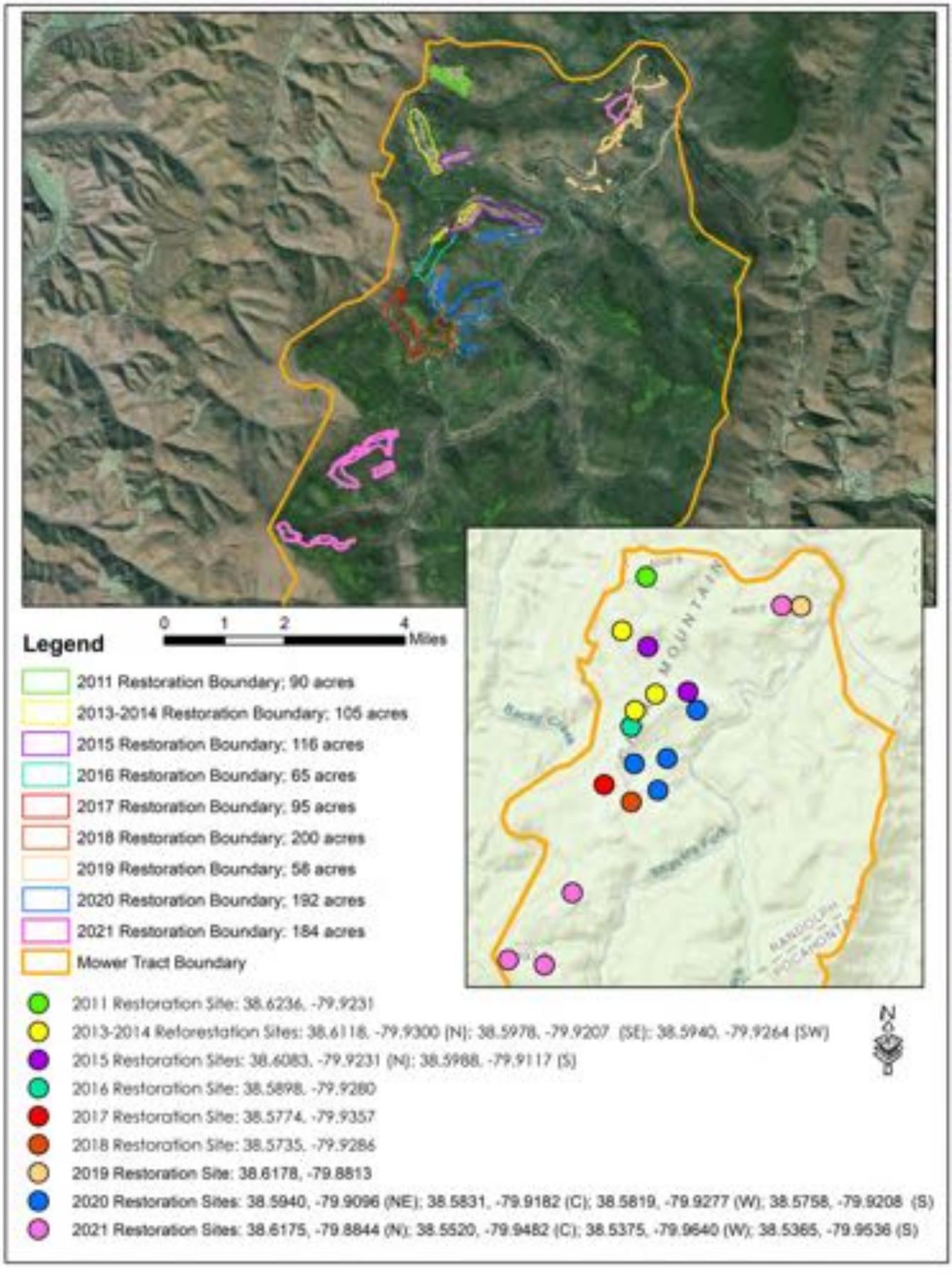


Figure 5. Mower Tract restoration areas.

RESTORATION ACTIVITIES

Non-native Species Removal

Grasslands and plantations of non-native trees, such as Norway spruce and red pine, were created on the mined areas during the reclamation process (see Figures 1 and 2, page 2). The non-native species that were seeded and planted did not provide the same ecosystem services as native red spruce and needed to be cleared before soil decompaction activities could be performed. Although the non-native pines and Norway spruce could tolerate the compacted soil better than many native tree species, they still did not develop healthy roots or grow vigorously. Since the stunted, non-native trees had little value for lumber or furniture, they were knocked down by a bulldozer or excavator, pushed into piles, and then scattered across the site after ripping (Figure 6). As they decompose, they will provide valuable functions on the site.

The dead wood provides a suitable growth medium for mosses, lichens, and fungi, which support a variety of wildlife. The woody debris also provides habitat for a variety of insects, birds, and mammals. As the wood decays, nutrients and organic matter are provided to the soil, increasing the soil's fertility and water-holding capacity. The downed trees also increase the rate of natural regeneration by acting as perches for songbirds such as Dark-eyed Juncos (*Junco hyemalis*), which spread native seed in their droppings. Fire cherry (*Prunus pensylvanica*) is not planted but can be seen growing prolifically amid the piles of downed trees. Colonization of fire cherry and other native species has been attributed to the "perch effect," which increases species richness and the abundance of locally adapted plants.

Aerial photographs of the 2013-2014 restoration site after non-native species removal and decompaction (left), and 8 years later, with planted red spruce dotting the ground (right).

Soil Decompaction

Mitigating soil compaction is the most critical step in putting mined lands on a trajectory toward becoming native forests. Loosening the soil allows native plants to naturally regenerate by providing a suitable medium for root growth, while planting trees facilitates the process. Ripping is typically done in the fall when the soil is dry to maximize soil fracturing.

Komatsu America Corp. has been providing equipment and funding to assist with site preparation since 2019. After the non-native trees are cleared by a Komatsu D61 bulldozer and PC210 excavator, local contractors rip the land using a Komatsu D155 bulldozer equipped with dual, rear-mounted ripping shanks (Figure 6). The shanks are spaced eight feet apart.

Wetland Creation

After the ripping and scattering of downed trees, a contractor is hired to create wetlands and vernal pools of varying depths and sizes. More than 1,450 wetlands have been created by an excavator based on observed drainage patterns, evaluation of soils and sub-surface conditions, and previous work in the Lambert Run watershed. Drainages between sediment ponds that were created by the mining company may also be improved. The wetlands are created to intercept and retain precipitation and groundwater and trap sediment. They also provide habitat for amphibians and other wildlife species, and they provide suitable conditions for 145 state rare plant species known to be associated with wetlands in the High Alleghenies, including 60 critically imperiled (S1) species, 56 imperiled (S2) species, and 29 vulnerable (S3) species.

Figure 6. A Komatsu D155 bulldozer decompacts the ground after non-native trees are pushed out of the way.

Figure 7. A Komatsu excavator scatters felled trees across ripped ground.

RESTORATION ACTIVITIES

Common name	2021
Red Spruce	61,811
Red Osier Dogwood	6,400
Black Cherry	6,000
Red Maple	6,000
Mountain Ash	5,896
Bigtooth/Quaking Aspen	4,600
Balsam Fir	4,430
Silky Dogwood	3,900
Willow	3,150
Ironwood	2,900
Witch hazel	2,350
Sugar Maple	2,100
Black Elderberry	1,750
Lowbush Blueberry	1,586
Hazelnut	1,150
Alternate Leaf Dogwood	1,023
Serviceberry	932
Red Elderberry	675
Black Chokeberry	500
Bush Honeysuckle (Native)	434
Speckled Alder	400
Chokecherry	400
Hawthorn	389
American Plum	300
Winterberry Holly	225
Ninebark	215
Cucumber Magnolia	76
Wild Raisin	75
Mountain Holly	25
Catberry	12
Common Milkweed	8
Black Raspberry	6
TOTAL	**119,718**

Table 3. Summary of native trees, shrubs, and herbaceous species planted in 2021.

Tree planters load a diverse mix of native trees and shrubs into their planting bags.

Forest Service staff organize trees before the planting contract begins.

Tree planters work their way through the 2021 restoration site planting 32 different species.

Planting of Native Species

In the spring following ripping, the reforestation sites and wetlands are planted with a variety of native plants by volunteers and professionals. Depending on the species, plants are established through direct seeding, or by the planting of bareroot seedlings, containerized/potted plants, and seedling plugs. To increase survival, the seeds and plants are purchased or grown from a locally adapted seed source. Each planting year from 2010 to 2019 the Natural Resources Conservation Service-Appalachian Plant Materials Center provided seeds or plants that were collected or propagated from locally adapted species.

Red spruce is the largest component of every planting, comprising 47 percent of the total seedlings planted. Other native species are selected based on their benefit to wildlife, their association with red spruce forests and wetlands in the High Alleghenies, and how they compete with red spruce. For example, aspen is the second largest component of the plantings overall, because it is a fast-growing species and provides food and cover for wildlife, helping to quickly establish an early successional habitat. Aspen are also short-lived compared to red spruce and northern hardwoods, so they will not compete with these trees and will eventually be overshadowed by them. The average planting density is 508 plants/acre, which leaves sufficient open spaces for natural regeneration.

EDUCATION & OUTREACH

More than 500 volunteers have participated in tree planting events on the Mower Tract, one of which was featured as a World Migratory Bird Day volunteer event. Volunteers over the past eleven years have primarily been students from local schools (elementary through vocational) and colleges. The planting events are an opportunity to teach the students about the importance of red spruce to the ecosystem, why wetlands matter, and the role that restoration plays in protecting ecosystems from climate change. In the past, volunteer events have been held for employees of two of our corporate sponsors, Komatsu and Grove Collaborative, as well as the Arbor Day Foundation and Appalachian Stewardship Foundation, two of our NGO partners. The restoration work has also been featured in several written and video media pieces, giving the project global exposure. Visitors to the Mower Tract can also learn about the restoration projects and site history by reading two educational kiosks that are prominently posted along the main forest road.

Volunteers from Chicago plant Cucumber magnolia in 2021.

Students from Green Bank Middle School learn about wetlands and the aquatic life they support.

Volunteer Testimonials

"This is my third time doing volunteer tree planting in Appalachia, but it's the first to narrowly focus on integration of the native habitat. Prior to our group planting, partners for the Mower Tract felled some of the non-native Norway Spruce creating a more realistic environment for rebuilding a forest. Rather than planting in a huge desolate area that had been stripped down to nothing, they had us plant native Red Spruce and Serviceberry in and around these downed trees. They also created pools, like mini 'wetlands', for salamanders, frogs and other wildlife. We found animal tracks and droppings in the areas we planted! This was encouraging and exciting for me to see. It's not only about the trees for me. I was happy to be a part of the renewal of an entire habitat."

--Tracy Janiak

"We always like a challenge and planting trees in and around felled non-native ones presented just that this year, but the holistic approach to integrating new native Red Spruce was fascinating. The idea of successive plantings to feed and encourage wildlife habitat made us feel good knowing that this region will profit greatly from such careful planning. We look forward to returning again to see the progress on this site!"

--Karin and Zenon Slawinski

"My day planting trees on Cheat Mountain with Green Forests Work was an amazing experience. My grandparents got engaged on this mountain in the early 1950s, so this area has a very special place in my family's history. Although the work was very physically demanding, it was extremely rewarding to know that even my small effort of planting one hundred or so trees that day will help return the land to a red spruce forest. The natural beauty of this area is spectacular yet the remaining scars of mining activity remind us that we have an obligation to help the land recover. I hope these reforestation efforts will continue on Cheat Mountain and other former surface mines in West Virginia. I look forward to volunteering again at future tree plantings."

--Karie Barbour

DISCUSSION

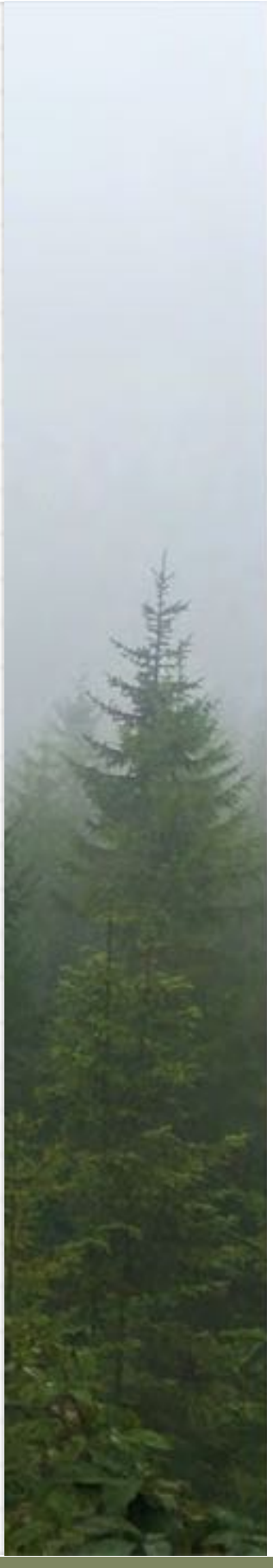
Although several more years of monitoring are needed to determine whether restoration efforts are truly successful, preliminary observations look promising, showing as much as 90% survival to date in some phases. A couple of monitoring protocols have been utilized, including the Central Appalachian Spruce Restoration Initiative's Rapid Assessment Monitoring Plan and the U.S. Forest Service's internal monitoring system, but the project partners do not feel that either of these protocols are well-suited for the restoration work. Future efforts will include creating a standardized monitoring program that more accurately captures the results of the restoration activities. Based on the large component of red spruce planted, the restoration sites are on a trajectory to becoming spruce-influenced forests (canopy must be 30 percent red spruce), which is a key goal of this project. The large number of aspen and diverse mix of other plants will create early successional habitat in the short-term, which is another key goal of the project.

Restoration areas to be planted in the spring of 2022 were recently decompacted and wetlands were created. Project partners plan to continue restoration efforts until all the mined areas in the Mower Tract have been restored. A list of major project partners and sponsors who have assisted in the restoration efforts over the years is provided on the next page.

2014-2015 restoration area becoming a young forest. Photo taken in 2021.

Project Sponsors and Partners

Arbor Day Foundation
American Forests
AmeriCorps, Appalachian Conservation Corp - Conservation Legacy
AmeriCorps, Appalachian Forest National Heritage Area
Appalachian Mountains Joint Venture
Appalachian Regional Commission
Appalachian Regional Reforestation Initiative
Appalachian Stewardship Foundation
Brad Stanback and Shelli Lodge-Stanback
Central Appalachian Spruce Restoration Initiative
Coal Country Beeworks
Canaan Valley Institute
Chicago Botanical Society
Claude Worthington Benedum Foundation
Environmental Protection Agency - American Rivers
Komatsu
Mennen Environmental Foundation
Mountain Ridge
National Forest Foundation
Natural Resources Conservation Service - Appalachian Plant Materials Center
Pisgah Banjo Company
The American Chestnut Foundation
Treecycler
The Mountain Institute
The Nature Conservancy
Ridgewater LLC
University of Kentucky
U.S. Forest Service - Monongahela National Forest
U.S. Fish and Wildlife Service
Northern West Virginia Brownfields Assistance Center
West Virginia Department of Environmental Protection
West Virginia Division of Natural Resources
West Virginia Division of Forestry
West Virginia Highlands Conservancy
West Virginia University



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