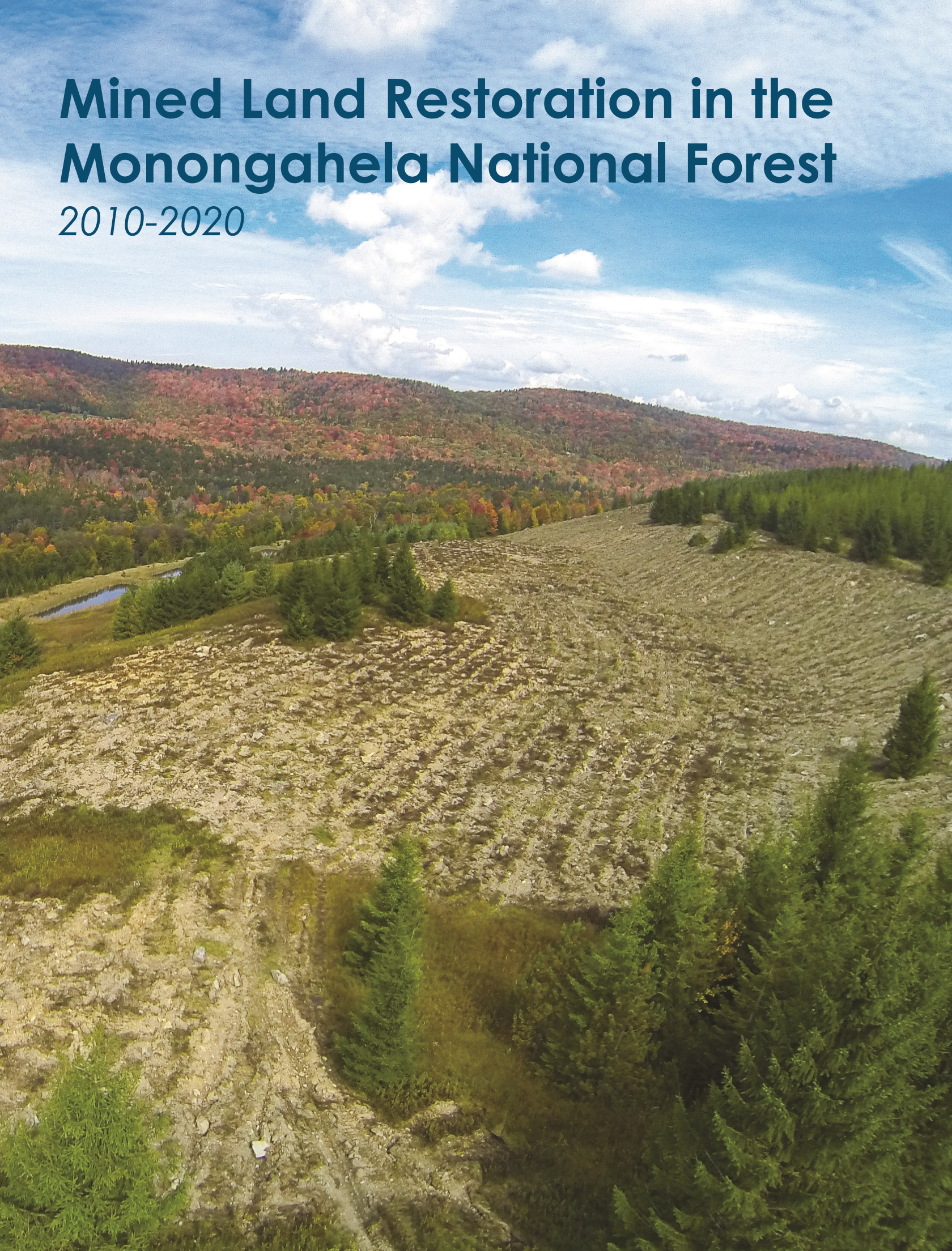
Mined Land Restoration in the Monongahela National Forest

2010-2020



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 three million trees across nearly 5,000 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: Aerial photograph of restoration site following soil de-compaction.

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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 1). 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. Areas where red spruce once existed were often replaced by even-aged, hardwood dominated forests, after unnaturally hot wildfires caused by clear-cut slash eliminated the red spruce seed source. 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 through the planting of non-native trees and seeding of aggressive grasses and legumes. The Mower Tract was reclaimed to non-native conifer plantations (Figure 2) and pasture (Figure 3) and remained as such for more than 30 years, as native species could not recolonize the sites because of the compacted soils and grass cover.

Starting in 2010, the US 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 de-compaction, 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 2. Non-native conifer plantations provide fewer ecosystem services than native forests.

Figure 3. Non-native grasses and soil compaction prevent native species colonization.

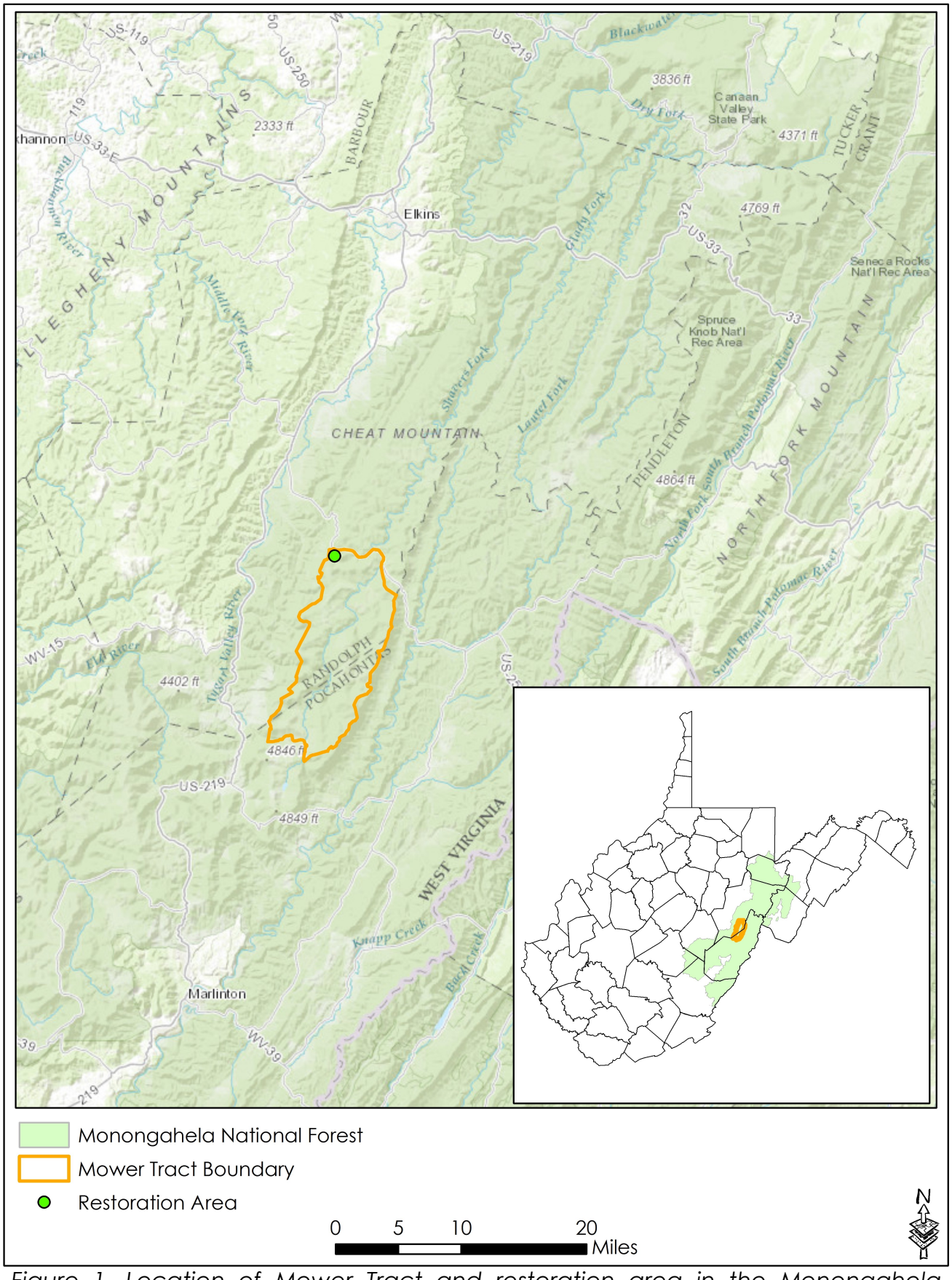


Figure 1. Location of Mower Tract and restoration area in the Monongahela National Forest

RESTORATION BENEFITS

Red Spruce

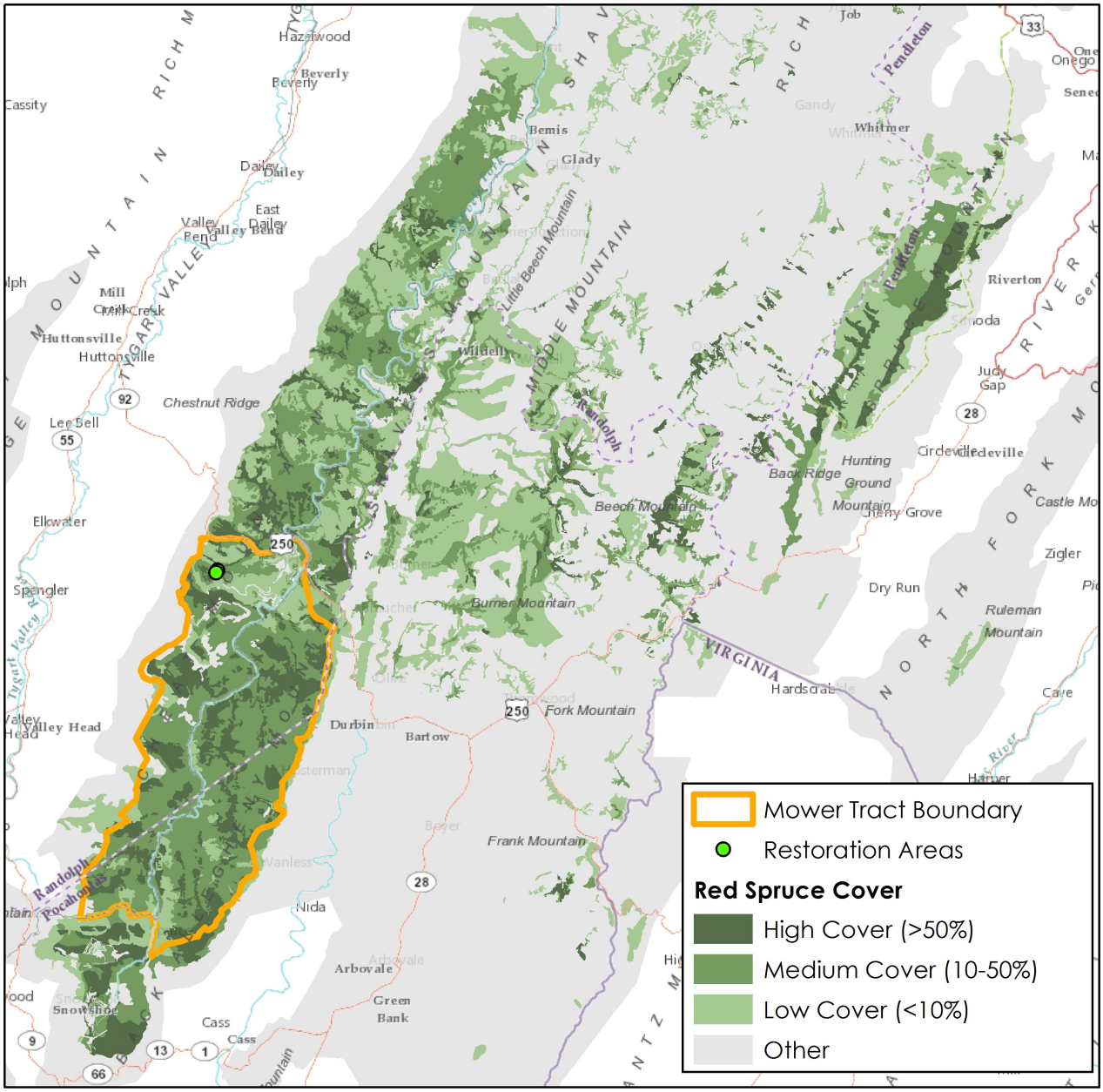
As previously mentioned, red spruce (*Picea rubens*) influenced forests have severely declined in West Virginia: The Red Spruce – Yellow Birch Forest (G2S2) and the Red Spruce – Southern Mountain Cranberry Forest (G2S1), which surrounds the Mower Tract, are imperiled[1] and critically impaired[2] communities 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 4). 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 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 4. Historic and actual red spruce cover in and surrounding the Mower Tract show how the restoration areas will help establish a 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 in 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.

A student volunteer explores the aquatic life in one of the created wetlands.

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

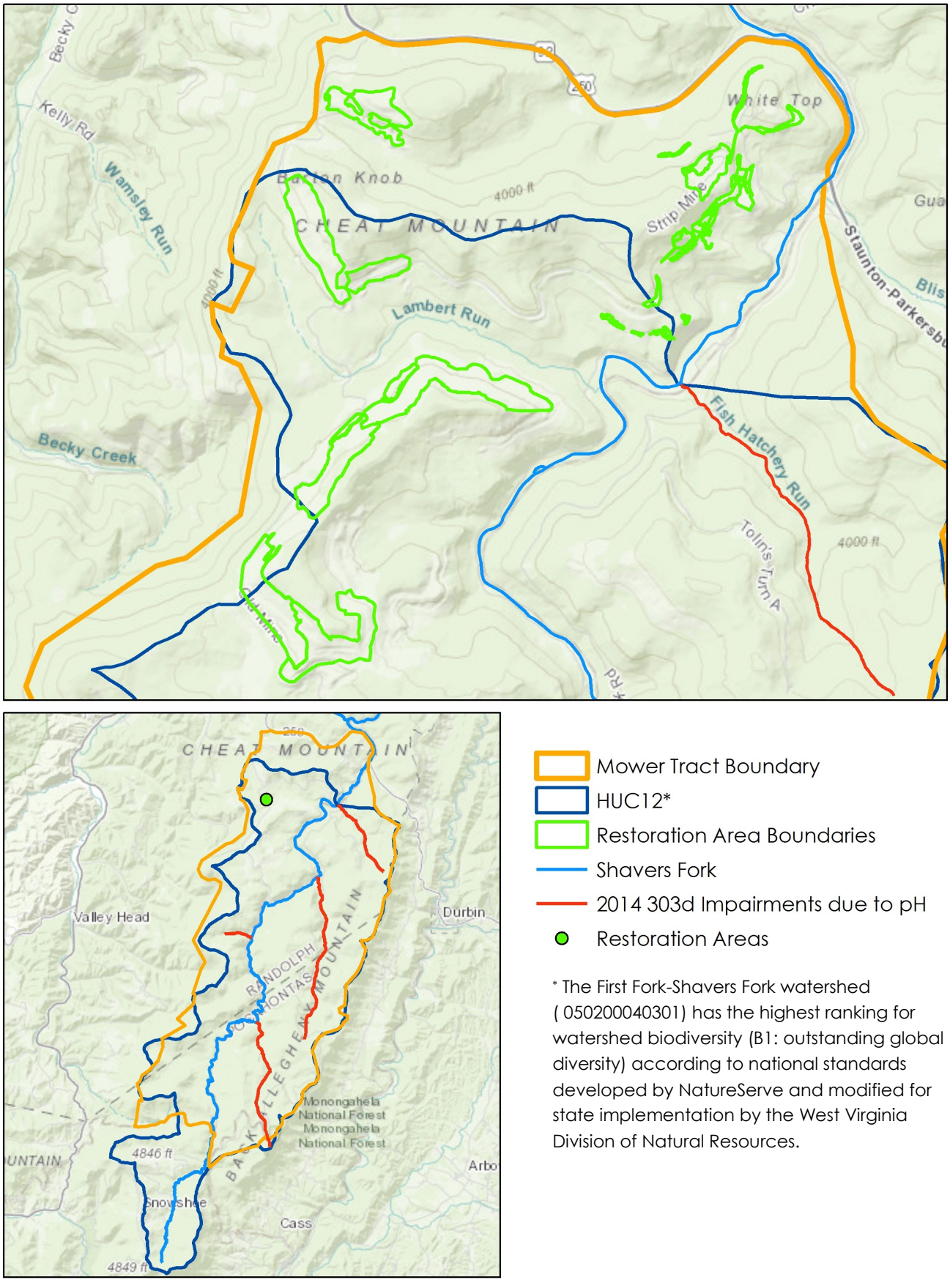
Water Quality

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 5). 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 de-compacting 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, and newly created wetlands will also help intercept and absorb some of the rainfall 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 5), so reduced acid loading could improve water chemistry.

Evidence of mine drainage is present near the restoration sites.



* The First Fork-Shavers Fork watershed (050200040301) 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 5. 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 economical 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 US Forest Service-Monongahela National Forest to begin establishing hiking trails through the restoration sites. These trails, 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 de-compaction, tree planting, wetland creation, and cultivation of seedlings have also put approximately one million 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.

HISTORY OF MINED LAND REFORESTATION PROCEDURE

Surface mining in Appalachia has replaced approximately one million acres of deciduous forest, some of the most diverse and valuable temperate 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. 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).

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 GFW implements on formerly mined lands.

RESTORATION ACTIVITIES

Since Green Forests Work began working with the US Forest Service-Monongahela National Forest and partners, restoration projects have taken place nearly annually on the Mower Tract (Figure 6). Prior to planting, non-native species were removed and the soil was de-compacted. In total, 964 acres have been restored. This has included the creation of more than 1,000 wetlands and the planting of nearly 450,000 plants (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)	Plants Planted	Wetlands Created	Volunteers Engaged
2011	90	22,550	135	60
2013-2014	105	28,485	75	117
2015	116	46,937	279	49
2016	65	35,436	100	90
2017	95	76,782	318	90
2018	200	93,308	175	14
2019	93[1]	51,108	192	85
2020	200[3]	92,318	84	n/a[2]
TOTAL	**964**	**446,924**	**1,358**	**505**

Table 2. Yearly summary of restoration activity.

[1]Of the 93 acres prepared, 60 acres were planted. The remaining area will be planted in 2021.

[2]No volunteer events were held in 2020 due to concerns about COVID-19.

[3]Eight additional acres of unripped slopes were planted, in addition to the 192 acres that were ripped.

Students from Green Bank Middle School plant a red spruce.

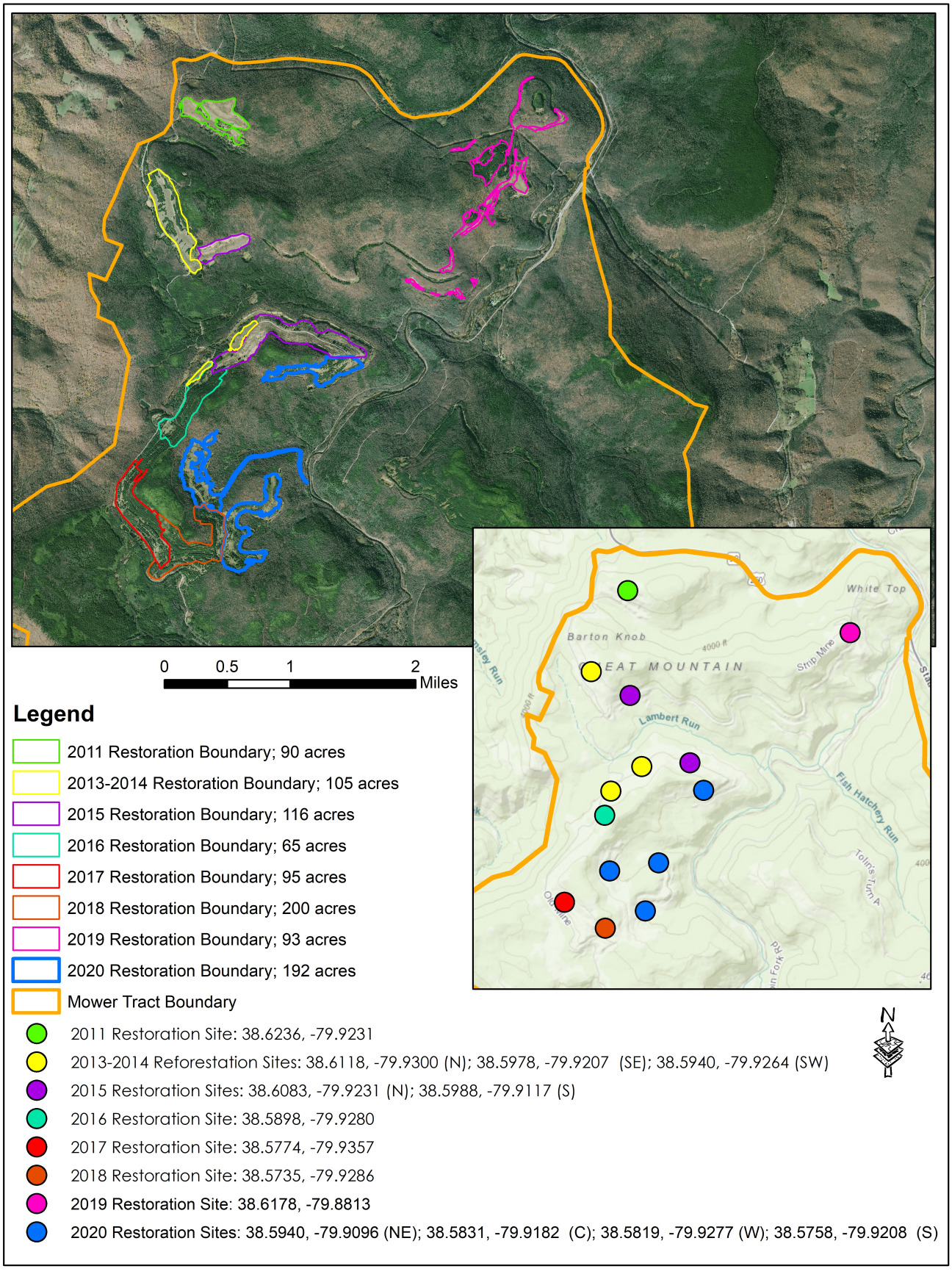


Figure 6. Restoration areas in the Mower Tract.

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 Figure 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 prior to ripping, pushed into piles, and then scattered across the site after ripping (Fig. 7). 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*) was not intentionally planted but has been seen growing next to the 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 photograph of the 2013-2014 restoration site following non-native species removal.

Soil De-Compaction

Mitigating soil compaction is the most important factor in putting mined lands on a trajectory toward becoming native forests. Loosening the soil allows a site to naturally regenerate by providing a suitable medium for plant growth, while plantings facilitate the process. Ripping is done when the soil is dry to maximize soil fracturing, typically in the fall.

Komatsu America Corp. provided equipment and funding to assist with the site preparation beginning in 2019. After the non-native trees had been cleared by a Komatsu D61 bulldozer and PC210 excavator, local contractors ripped 192 acres using a Komatsu D155 bulldozer equipped with dual, rear-mounted ripping shanks. The shanks were spaced eight feet apart, and the sites were cross-ripped (ripped in perpendicular directions) to create an 8-foot by 8-foot grid after cross-ripping.

Wetland Creation

After the ripping and scattering of downed trees, a contractor was hired to create wetlands and vernal pools of varying depths and sizes (Fig. 8). More than 1,300 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 were also improved. The wetlands were 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 7. A Komatsu D61 bulldozer pushes felled trees across ripped ground.

Figure 8. Tadpoles and egg masses are visible in a wetland created in 2019.

RESTORATION ACTIVITIES

Species	2011	2013-14[1]	2015	2016	2017	2018	2019	2020	Total
Red Spruce	9,020	15,185	25,736	25,000	25,378	41,036	25,000	38,016	**204,371**
Aspen (mixed)	1,127	3,274	4,051	2,050	11,215	9,100	12,000	14,000	**56,817**
Speckled Alder			1,800	750	14,680	8,833	7,085	8,250	**41,398**
Black Cherry	1,410	7,600	1,000	1,100	2,601	3,000	1,000	8,610	**26,321**
Winterberry Holly			2,850	650	5,624	4,880	18	440	**14,462**
Arrowood			3,000	850	4,790	1,036	26	530	**10,232**
Mountain Ash	1,410		2,000	650	1,632	3,794	100	25	**9,611**
Sugar Maple	1,410				3,021	3,000	500		**7,931**
Serviceberry	1,410	500	1,500	875	1,156	1,000		5	**6,446**
Chokecherry				90	110	4,618		538	**5,356**
Silky Dogwood					1,300	2,500	518	6,125	**10,443**
Wild Raisin	564	1,526		65	775	1,855	93		**4,878**
Hazelnut			1,800	550	400	1,500	15	1,000	**5,265**
Cucumber Magnolia	1,405		2,700	300	18	5		250	**4,678**
American Chestnut				511	500	1,800	500	247	**3,558**
Red Maple	1,410				32	1,800	500		**3,742**
Black Chokeberry					200		2,108	5,000	**7,308**
Common Elderberry	564	400		800		500			**2,264**
Basswood			500		1,095			2	**1,597**
Hawthorn					404	995			**1,399**
Red Osier Dogwood							1,000	4,000	**5,000**
Red Oak						700			**700**
Lowbush Blueberry				320		240	97		**657**
Blackhaw					650	2			**652**
Nannyberry				75	360	1			**436**
Red Elderberry				300	80		24	967	**1,371**
Black Elderberry					326				**326**
Penstemon				100	180				**280**
Fraser Magnolia					91	75	98	75	**339**
Pin Cherry						250			**250**
Bear Oak						240			**240**
Silky Willow						200			**200**
Willow						148	26		**174**
Smooth Oxeye				150					**150**
Alternate Leaf Dogwood						144		808	**952**
Red Raspberry					1		100		**101**
Late Figwort				100					**100**
Red Chokeberry					100				**100**
Bush Honeysuckle[2]							100		**100**

*Table 3. Yearly summary of **native** species planted.*

Species	2011	2013-14[1]	2015	2016	2017	2018	2019	2020	Total
Steeplebush, Pipestem							100		**100**
Sweet Fern							100		**100**
Highbush Cranberry				75					**75**
Red Mulberry				75					**75**
Swamp Rose						34			**34**
Black Birch					33				**33**
Hemlock					23				**23**
Mountain Holly						7			**7**
Skunk Currant						6			**6**
Beech	1,410				5				**1,415**
Wild Grape						3			**3**
Yellow Birch	1,410				1	2			**1,413**
Sumac						2			**2**
Devil's Walkingstick					1				**1**
Ninebark								3,000	**3,000**
Other						2		430	**432**
TOTAL	**22,550**	**28,485**	**46,937**	**35,436**	**76,782**	**93,308**	**51,108**	**92,318**	**446,924**

*Table 3 (cont.). Yearly summary of **native** species planted.*

[1] 72 pounds of locally collected native seed from the NRCS-APMC were also sown throughout restoration area.
[2] This is a native species of bush honeysuckle.

Planting of Native Species

In the spring following ripping, the reforestation sites and wetlands were planted with a variety of native plants by volunteers and professionals. Depending on the species, plants were established through direct seeding, or by the planting of bareroot seedlings, containerized/potted plants, and seedling plugs. To increase survival, the seeds and plants were purchased or grown from a locally adapted seed source. Every planting year, 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 46 percent of the total species planted (Table 3). Other native species were 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 was 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 464 plants/acre, which leaves sufficient open spaces for natural regeneration.

EDUCATION & OUTREACH

More than 500 volunteers have participated in the planting events, one of which was featured as a World Migratory Bird Day volunteer event. Volunteers over the past ten years have primarily been students from local schools (elementary through vocational) and colleges. The planting events are used as 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 2019, volunteer events were 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 (Fig. 9). 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 project road.

Figure 9. Volunteers with Komatsu interplant red spruce in 2019.

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 wild life 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 is 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 US 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 appear to be on a trajectory to becoming spruce-influenced forest (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 should create early successional habitat in the short-term, which is another key goal of the project.

Restoration areas for the spring of 2021 and beyond are currently being delineated. Project partners hope 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.

2015 planting site growing nicely (photo taken 2018)

Project Sponsors and Partners

A Living Tribute
AmeriCorps
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American Forests
Appalachian Mountains Joint Venture
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Appalachian Regional Reforestation Initiative
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The Central Appalachian Spruce Restoration Initiative
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