# green forests work

# 2024 ANNUAL REPORT

Restoring healthy and productive forests on formerly mined lands in Appalachia and beyond.

greenforestswork.org



### **OUR MISSION**

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

### **OUR 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 native 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 nearly 7 million trees across more than 13,000 acres.

### **OUR APPROACH**

To mitigate the landscape impacts of conventional mine reclamation, various combinations of site preparation are used. The first step in reforestation is to control the established, unwanted vegetation that would out-compete or severely impact native tree survival and growth. Depending on the length of time since reclamation and vegetation present, different vegetative control techniques may be required. On some mined lands, many native species have established, and no treatment is necessary. On others, aggressive grasses and legumes may need to be treated with herbicides through a broadcast application of a non-selective herbicide. When much time has elapsed and large patches of invasive shrubs or exotic trees have established, removing the vegetation and seedbank entirely may be required. This is often accomplished by "scraping" off the brush, roots, and top few inches of soil, which contains a seedbank of unwanted species, into piles at the perimeter of the project area.

After unwanted vegetation is controlled, the compacted ground must be loosened to improve water infiltration and gas exchange and to allow seedlings' roots to extend easily through the soil. Ripping will be conducted by pulling one or two three-foot ripping shank(s), fully immersed in the soil, behind a large bulldozer. Flat areas, rolling terrain, and gentle slopes are cross-ripped by first ripping perpendicular to the slope and then ripping parallel to the slope. When areas are narrow or small, or



A shortleaf pine (Pinus echinata) planted on a former coal mine site in Kentucky. Shortleaf pine forests were once abundant in the eastern United States. Over the last three decades, the shortleaf pine forest has seen significant reductions due to pine beetle infestations, poor management, land-use changes and altered fire regimes. Many of the coal mines in Cumberland Plateau were shortleaf pine/upland oak stands prior to mining and it is our intention to bring back those lost forests. Over the last decade Green Forests Work has planted hundreds of thousands of shortleaf pines in focal areas identified for the restoration of this forest type. Working with the National Fish and Wildlife Foundation, the Arbor Day Foundation, U.S. Forest Service, The Nature Conservancy and Suntory Global Spirits, thousands of acres have been restored.

there are a lot of steeper slopes, cross-ripping can be conducted by an excavator equipped with a single shank ripper. Ripping is best accomplished in the fall when the ground is dry. This maximizes fracturing of the soil and allows the equipment operator to rip steeper slopes safely. The rips will be spaced 8 feet apart, and cross-ripping prevents surface water from running down the furrows during storm events, allowing tree roots to extend in multiple directions. The ripping creates a rough ground surface and exposes large rocks, creating microsites that will provide cover for insects, ground-nesting birds, small mammals, reptiles, and amphibians.



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**ON THE COVER** Volunteers, corporate sponsors and professional tree planters worked to restore native forests on former coal mines across the Appalachian region in 2024.



#### VISIT OUR WEBSITE

Scan the QR code to access Green Forests Work's website. There, you can catch up on our newsletters, read more about our work, watch videos, and more.

# LETTER FROM THE PRESIDENT

In July 2022, between 14 and 16 inches of rain fell on parts of eastern Kentucky one evening. The National Weather Service indicated that it was the deadliest non-tropical flood event in the United States since the late 1970s. Forty-five people died, 9,000 homes were destroyed, and hundreds of families were displaced. This September, Hurricane Helene caused widespread destruction across the southeast United States, killing hundreds and displacing thousands, with estimated losses from damage to homes, industry, roads, bridges, and agriculture that may exceed \$100 billion. Although the two catastrophic weather events had differing origins, climatologists have stated that both were exacerbated by global temperature rise associated with climate change.

Rural communities, especially those in the economically disadvantaged Appalachian region, have been hit particularly hard by the recent climate disasters. Moreover, landscape alterations Dr. Chris Barton stands in a reforestation area at Kentuckv linked with climate change compound the likelihood that these types of events



River Properties that he planted in 2006.

reclamation techniques inhibit water infiltration into mine soils. Sites reclaimed using our reforestation methods exhibited a soil-water environment that was more similar to the naturally forested unmined control. With projected changes to precipitation patterns that may result in more high-intensity storms, reforestation of these disturbed landscapes may help reduce the likelihood of flooding. To build upon our knowledge of the effects of land use and climate change on flooding in Appalachia, a new study awarded by the National Science Foundation has been initiated. Working with scientists and engineers from the University of Kentucky, the University of Louisville, Eastern Kentucky University, West Virginia University, and Marshall University, it is my hope that we are able to heal the landscape and build up our infrastructure to understand, predict and prepare for flooding in Appalachia.

Planting native forests is certainly one action we can employ that will protect lives and improve our livelihoods. Our work to reforest Appalachia is now more important than ever. As we seek answers to improving our environment and climate, we see hope with the many millions of trees we have planted

may become more frequent. In 2020, Dr. Tanja Williamson with the US Geological Survey and I published a paper looking at the effects of reforestation and climate change on mineland hydrology in Appalachia. Our study showed that conventional grassland

and tens of thousands of acres that are growing into forests. We are very appreciative of all the past and future support that allows us to take on this important task.

Chris Barton

# **2024 YEAR IN REVIEW**

While 2023 was the hottest year in the past 140 years, it is virtually certain that 2024 will be hotter. With the warming planet, communities have experienced increasingly severe weather events that would be extremely unlikely or impossible without the additional warming caused by the accumulation of greenhouse gases in the atmosphere due to the burning of fossil fuels. Many of our friends, supporters, and colleagues will need assistance for several years to rebuild their communities after the devastating flooding and impacts from hurricanes Helene and Milton that tore through the southern Appalachians and Florida, while communities in the western US and Canada are still rebuilding after recordbreaking wildfires from 2023. It is imperative that we, as individuals and as a society, act immediately to reduce our reliance on fossil fuels and restore native ecosystems' abilities to sequester carbon to mitigate the effects of global warming.

Research and dozens of GFW's previous projects have demonstrated that productive and diverse forests can be established on former coal mines. When properly prepared, mine soils can provide a deep rooting medium, be rich in geologically derived nutrients such as calcium, phosphorous, iron, sulfur, and magnesium, and produce forests with similar growth characteristics as those of pre-mined native forests. Many former surface mines in Appalachia and worldwide



Late summer of 2024 and a view of a site owned by Kentucky River Properties that had been recently prepped for a spring 2025 planting.

may be some of the best places to plant trees when considering climate change mitigation. The soils of surface mines initially have little to no organic carbon. When former mines are properly rehabilitated, they may serve as carbon sinks for centuries as the forests mature and soils are rebuilt.

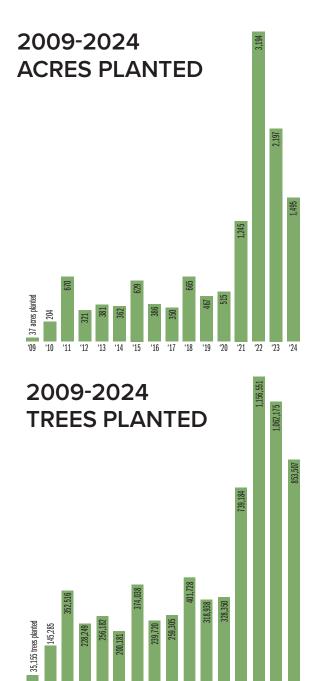
GFW has been working diligently this past year to scale up reforestation efforts in the coming years. We have continued collaborating with our long-term partners and have developed new partnerships, allowing us to undertake additional projects. We hired Eric Oliver to assist with project development and implementation and to develop an inventory of potential restoration sites across Appalachia to help us prioritize sites to meet multiple restoration objectives. We have also worked to improve the outcomes of our ecological restoration projects. Although our seedling survival rates are typically high, we installed research plots to determine which type of planting stock for red spruce and shortleaf pine results in higher survival rates, and we have also been sowing more native warm-season grasses and wildflowers as a part of our restoration projects to provide an immediate increase to biodiversity and to benefit pollinators. As we continue to build a better future, we would like to thank all of our partners, donors, and supporters, who have helped to make this restoration work a reality.

# **2024 BY THE NUMBERS**

In 2024, Green Forests Work supported reforestation projects in seven states. Over 800,000 trees were planted on nearly 1,500 acres. Projects were implemented in the New River Gorge National Park and the Monongahela National Forest in West Virginia and private lands in Kentucky, Pennsylvania, Tennessee, Indiana, Ohio, and Maryland. As we move toward 2025, new projects in Virginia and on private land adjacent to previously restored lands on the Monongahela National Forest will be initiated.

### **2024 STATISTICS**





·10 ·11

·12 ·13 ·14

'15 '16 '17 '18 '19

# WEST VIRGINIA PROJECTS

Mower

Tract

WV

### MOWER TRACT AND NEW RIVER GORGE

GFW, USDA Forest Service, Monongahela National Forest (MNF), USDI National Park Service, New River Gorge (NRG) National Park and Preserve, and other partners have initiated a project to restore native forests on lands disturbed by surface coal mining in the Central Appalachian Region. This collaborative, science-based restoration project addresses priority goals associated with the Central Appalachian Spruce Restoration Initiative and the White Oak Initiative. The project includes reclaimed mine tracts in West Virginia in the MNF and in the NRG. Restoration activities included invasive plant control, soil decompaction, pond decommissioning, and planting of native trees and shrubs.



Contractors walk to a red spruce planting site on an early spring morning at the Mower Tract.

### RED SPRUCE RESTORATION BENEFITS

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<sup>1</sup> and critically imperiled<sup>2</sup> 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. 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. 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.

<sup>1</sup>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.

<sup>2</sup> 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.

# MOWER TRACT MINE POND DECOMMISSIONING

On the Mower Tract, a series of over one hundred abandoned sediment ponds border the downgradient side of the restoration area. Due to heavy compaction from mining equipment, water could not infiltrate the soil. It flowed quickly over the land's surface, collected in the sediment ponds, was exposed to air temperatures and sunlight, and warmed significantly before overflowing to streams and forest below the mined areas, contributing thermal pollution to the headwater streams in the Shavers Fork watershed. These warmer waters are increasing the temperature of this habitat, which supports aquatic life dependent on cold waters, such as native brook trout.

To address the problem, GFW initiated a project in 2023 to decommission the ponds and turn them into complexes of small wetlands with significantly reduced ponded areas.

Ultimately, 60 acres will be converted into wetland complexes, and due to the extensive earthmoving and restructuring required, this will be implemented in stages. In the spring, Phase 1 involved removing 18 ponds from 23 acres, and the site was planted with 100,754 trees and wetland shrubs that will eventually shade the area. Additionally, 100 pounds of native wildflowers, legumes, and grass seeds were spread across the area.



Top: Aerial view of the ponds before work begins on their removal. Above: Post removal landscape in an area where one of the ponds was decommissioned.

## **VOLUNTEER EVENT**

This spring, a one-acre section was prepped for a volunteer tree-planting event with Komatsu. GFW, USFS staff, and Komatsu executive staff toured the restoration areas and planted 1,500 red spruce and 89 native honeysuckle and dogwood. Although professionals have accomplished most of the planting, 555 volunteers have assisted in these efforts over the years (Table 1).





Employees from Komatsu learn about spruce restoration on the MNF from Greenbrier Ranger Jack Tribble and later plant trees. Right: Tree planters move across a hillslope at the Mower Tract and put the finishing touches on upland planting efforts there.

#### Wetlands # Trees and **# Species** Volunteers Year Restoration **Shrubs Planted** Planted Area (ac) Created Planted Engaged 2011 90 135 22,550 12 60 2013-2014 105 75 8 117 28,485 2015 116 279 46,937 11 49 2016 65 100 35,436 22 90 2017 95 318 76.782 32 90 2018 200 175 93.308 35 14 2019 58 192 51,108 23 85 200<sup>1</sup> 84 21 0 2020 92,318 2021 32 184 108 119,718 20 2022 189<sup>2</sup> 180 117.452 31 0 2023 160 105,215 20 0 60 2024 **28**<sup>3</sup> **18**<sup>4</sup> 102,343 19 30 891,652 60 <u>total⁵</u> TOTAL 1,490 1,724 555

<sup>1</sup> In addition to the 192 ripped acres, 8 acres of nonripped slopes were planted.

<sup>2</sup> In addition to the 171 ripped acres, 18 acres of land ripped in the past project years were planted.

<sup>3</sup> In addition to the 28 fluffed acres where wetland complexes were built, 36 acres of land ripped in past project years were supplementally planted.

<sup>4</sup> Each eliminated pond retained an isolated wetland feature.

<sup>5</sup> There is overlap in the species planted each year. Across all years, a total of 60 different species have been planted.



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#### Table 1. Yearly summary of restoration activities.

# **NEW RIVER GORGE**

### WAR RIDGE

The War Ridge site, comprised of four small areas that were surface mined from the late 1980s to the early 1990s and connected by haul roads, is located on Backus Mountain in Fayette County, WV.

The long-term goal is to restore an upland oak-hickory forest type. Site preparation was completed during the first week of March, and the site was planted in late March. A planting crew



planted 26 acres with 18,650 tree and shrub seedlings of 21 species, and approximately 15 lbs of wetland seeds were spread. Furthermore, wetlands were created, with four vernal pools and a series of step pools covering a total of 30 acres.

GFW and NRG staff were joined by 24 volunteers for a tree-planting event on April 20th, during which 2,400 trees were planted across 4 acres.

### **HYLTON STRIP**

GFW staff and NRG's natural resource staff aimed to restore an upland oak-hickory forest and remove man-made structures at the Hylton Strip property on Highland Mountain in Fayette County, WV.

Site prep, including vegetation removal and cross-ripping, was conducted on 107 acres and completed in late March, and planting began on the same day. A planting crew planted 76,850 trees and shrub seedlings over three days. Additionally, 350 pounds of native warm-season grass and wildflower seeds were spread over 75 acres. NRG staff also spread approximately 5 pounds of wetland seeds around two streams and wetland area.





Top and above: Volunteers plant trees at the War Ridge site on April 20, 2024.



Before (top) and after (above) site prep at the Hylton Strip restoration area in the NRG.

# **KENTUCKY PROJECTS**

## KENTUCKY RIVER PROPERTIES AND ATAYA

In partnership with the National Fish and Wildlife Foundation, these projects restore shortleaf pine-upland oak forest types, improve air and water quality and forest resiliency, and improve wildlife habitat on The Nature Conservancy's Ataya property and Kentucky River Properties (KRP) land in eastern Kentucky. Nearly 400,000 trees will be planted on multiple tracts across approximately 560 acres, all within the freshwater and terrestrial focal area of the Cumberland Plateau Stewardship program boundary.

Site preparation on 228 acres was completed in early January 2024, and a planting crew planted 142,260 tree and shrub seedlings, consisting of 20 species, across approximately 137 acres in early February. The planters also broadcast 1,110 pounds of native warm-season grasses and wildflower seeds.

Approximately 15 acres were reserved for two volunteer planting events in the spring of 2024. 75 Suntory Global Spirits volunteers planted 7,000 trees across 10 acres, and 50 University of Kentucky and Berea College students planted 2,480 trees across 5 acres of the 152-acre KRP project area.



GFW, TNC, and Suntory Global Spirits partnership have planted nearly 250,000 trees on former mine sites in eastern Kentucky in the last three years.



University of Kentucky and Berea College students planted at the KRP site in March.



In August, we hosted a field tour to showcase our Central Appalachian Stewardship projects. Participants included representatives from the U.S. Forest Service, the USDI National Park Service, the National Fish and Wildlife Foundation, Woods and Water Consulting, the Arbor Day Foundation, and Clayton Homes. They toured restoration sites on the Monongahela National Forest and the New River Gorge,

discussing the outcomes of the efforts. Scan the QR code to learn more about this initiative and watch a video



featuring our staff, produced by the Arbor Day Foundation.

# PENNSYLVANIA PROJECTS HIGHLIGHTS

GFW and our PA partners planted and/or supported 2 mined land restoration projects, 3.5 state game land (SGL) forest underplantings, and 7 volunteer events in PA this year. A total of 359,755 native tree seedlings were planted on 850 acres.

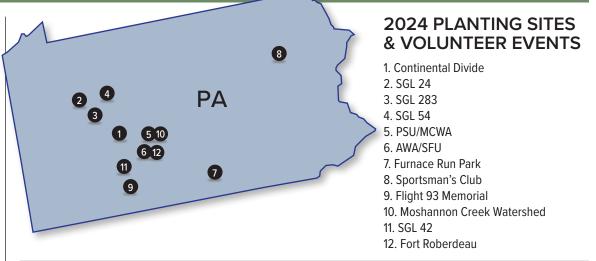
#### MINED LAND PROJECTS: CONTINENTAL DIVIDE 2024

The Continental Divide restoration project encompasses two watersheds: the Chesapeake Bay Watershed and the Ohio River Watershed. This initiative aims to restore approximately 300 acres of land that have been previously mined and are owned by several landowners. The project will be carried out in two phases: Phase One will restore 137 acres in 2024, while Phase Two will focus on an additional 100 to 150 acres in 2025.

Phase One was completed in early April and 132,310 seedlings from 24 native tree species were planted.



Planters dip seedling roots in a mixture to keep them moist during the planting process.



#### SGL 42: SUGAR RUN RESERVOIR ABANDONED MINE REFORESTATION

In mid-April, crews planted 9,375 trees across 11 acres at SGL 42, which is known as Sugar Run Reservoir in Westmoreland County. The reclamation area eliminated a dangerous highwall and a spoil pile that remained on the site after mining activities were completed. The spoil was used to regrade the area to its approximate the original contour and eliminate the high wall, thereby restoring surface water drainage patterns on the site.



Planters plant on decompacted mined land reclaimed to eliminate highwalls and water quality issues.



The professional planters use a tool called a hoedad to slice open the earth and loosen the soil before planting each seedling.

#### 2024 CLAWSON RUN CONIFER UNDERPLANTING AT SGL 283

In mid April, SGL 283, located within the Clarion River watershed, and part of the Ohio River Basin in Pennsylvania was planted with 64,865 conifer seedlings across 213 acres to enhance wildlife habitat, increase species diversity, and improve vertical structure after the discovery of the hemlock woolly adelgid.

Areas for treatment and conifer underplanting will strengthen the forest's resilience against this invasive insect. Improving connectivity of conifer corridors, especially along threatened hemlock drainages in the Game Lands, is also vital.

#### 2024 RAUGHT RUN CONIFER UNDERPLANTING AT SGL 54

SGL 054 is located within the Clarion River watershed and is part of the Ohio River Basin. The project area is a high-quality stream corridor where brook trout are known to breed. From April 19-24, crews planted 84,050 trees with 4 native trees species over 264 acres. The plantings will provide diversity in structure, as well as thermal cover.

Professional planters hike into the project area, past an area that was impacted by severe winds and timber was salvaged.

#### SGL 24: GOAT PATH CONIFER UNDERPLANTING AND COMPLETION OF 2023 SKIDMARK CONIFER UNDERPLANTING

In mid-April, 43,980 trees from 4 native tree species were planted on 142 acres at State Game Lane (SGL) 24, located in Forest County, PA.

On April 15, GFW returned to the Skidmark project in Forest and Clarion Counties, PA and planted 17,000 conifer seedlings over 57 acres.

The objectives of this planting project were to occupy growing space with planted conifer seedlings to enhance wildlife habitat and species diversity, diversify vertical structure, and increase the conifer component within these degraded stands.







Top: Professional planters count, prepare, and stuff seedlings into their planting bags. Above: Seedlings are planted at SGL 24's Skidmark project site.

#### PENNSYLVANIA VOLUNTEER PLANTING EVENTS

Date	Location	Event	Volunteers	# Planted	Acres	Species
4/6	Centre Co.	PSU/MCWA	40	2,000	2	11
4/12-13	Blair Co.	AWA/SFU	24	1,900	3	7
4/12	Franklin Co.	Furnace Run Park	25	1,500	4	7
4/16	Wyoming Co.	Factoryville Sportsman's Club	9	375	1	12
4/21	Blair Co.	Fort Roberdeau	50	400	1	10
4/26	Somerset Co	Flight 93 Memorial	100	600	1	4
4/26	Centre Co.	Moshannon Creek Watershed	35	700	3	7
			283	7,475	15	













More than 280 volunteers planted over 7,000 trees at seven volunteer planting events in Pennsylvania in 2024.

# **TREE SPECIES PLANTED 2024**

Table 3. Species of trees planted at the variousproject sites featured in this report in 2024.

\* KY includes KRP and Ataya sites. \*\* PA includes all State Game Land (SGL) and volunteer planting events.





Top: Planters at Kentucky River Properties site. Above: Balsam Fir seedlings ready to be planted.

Species	MNF	NRG	KY*	<b>PA</b> **		MNF	NRG	KY*	<b>PA</b> **
Alternate Leaf Dogwood	•				Ninebark	•			
American Chestnut	•	•	•	•	Pawpaw				•
American Crabapple				•	Persimmon		•	•	•
American Mountain Ash	•				Pin Cherry	•			
American Plum	•				Redbud		•	•	•
Arrowood Viburnum	•				Red Chokeberry	•			
Balsam Fir	•			•	Red Elderberry	•			
Basswood	•				Red Maple	•	•	•	
Bear Oak	•				Red Mulberry	•	•	•	
Beech	•			•	Red Oak	•	•	•	•
Bigtooth/Quaking Aspen	•			•	Red Osier Dogwood	•			
Black Birch	•				Red Raspberry	•			
Black Cherry	•	•	•	•	Red Spruce	•			•
Black Chokeberry	•			•	River Birch		•		
Black Elderberry	•				Scarlet Oak		•		
Black Gum		•		•	Serviceberry	•			•
Black Locust		•	•	•	Shagbark Hickory		•	•	
Black Oak		•	•		Shortleaf Pine			•	
Black Raspberry	•				Silky Dogwood	•		•	•
Blackhaw	•				Silky Willow	•			
Bush Honeysuckle (Native)	•				Skunk Current	•			
Catberry	•				Speckled Alder	•			
Chestnut Oak		•	•	•	Staghorn Sumac	•			
Chokecherry	•				Steeplebush, Pipestem	•			
Cucumber Magnolia	•				Sugar Maple	•	•		•
Devil's Walkingstick	•				Swamp Rose	•			
Flowering Dogwood		•			Sweet Birch		•	•	
Fraser Magnolia	•				Sycamore			•	•
Hawthorn	•				Virginia Pine		•		•
Hazel/Smooth Alder	•				White Oak	•	•	•	•
Hazelnut	•		•	•	White Pine	•		•	
Hemlock	•				White Spruce			•	
Highbush Cranberry	•				Wild Grape	•			
Ironwood	•				Wild Plum		•	•	
Late Figwort	•				Wild Raisin	•			
Lowbush Blueberry	•				Willow	•			
Maple Leaf Viburnum	•				Winterberry Holly	•			•
Mountain Holly	•				Witch Hazel	٠			•
Mountain Maple	•				Yellow Birch	•			
Nannyberry	•			•	Yellow Poplar		•	•	•

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