The Central Appalachian Spruce Restoration Initiative

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2013 YEAR-END REPORT FOR THE CENTRAL APPALACHIAN SPRUCE RESTORATION INITIATIVE

SUMMARY

The Central Appalachian Spruce Restoration Initiative (CASRI) is a partnership of diverse interests who share the common goal of restoring the red spruce-northern hardwood ecosystem across the high-elevation landscapes of the Central Appalachians. This ecosystem, which supports many species that are rare in the region, was decimated by exploitative logging a century ago and is now making a slow recovery. CASRI is comprised of private, state, federal, and non-governmental organizations that recognize restoration of this ecosystem as imperative for maintaining the ecological integrity of the Central Appalachians.

CASRI includes the following partners:

Appalachian Mountain Joint Venture (AMJV), Appalachian Regional Reforestation Initiative (ARRI), Appalachian Landscape Conservation Cooperative (APPLCC), Canaan Valley National Wildlife Refuge (CVNWR), Green Forest Works (GFW), Natural Resources Conservation Service (NRCS), The Mountain Institute (TMI), The Nature Conservancy (TNC), Trout Unlimited (TU), U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service Northern Research Station (NRS), U.S. Forest Service Monongahela National Forest (USFS-MOF), West Virginia Division of Natural Resources (WVDNR), West Virginia Division of Forestry (WVDOF), West Virginia Highlands Conservancy (WVHC), West Virginia State Parks, and West Virginia University (WVU).

The CASRI partnership began as a small working group that was formed to conserve the endangered (and since de-listed) West Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*), which depends on the red spruce-northern hardwood ecosystem. As the partnership grew, it broadened into a multi-faceted ecosystem restoration effort that seeks to address such issues as plant diversity, wildlife diversity, climate change, adaptation, spruce regeneration, recreation, aesthetics, pollinator recovery, public education and interpretation, soils, private land timber restoration, and connectivity between public and privately owned habitats. The thread that connects all members of CASRI is the determination to restore red spruce-northern hardwood ecosystems and the diversity of plants and wildlife it supports. The CASRI partnership seeks to fulfill the following vision:

CASRI envisions a functioning red spruce-northern hardwood forest ecosystem restored across portions of its former range on both public and private lands, with the scale, connectivity,

maturity and other features that provide habitat to sustain and enhance the viability of the many species and natural communities dependent on this ecosystem.

In 2010, CASRI developed a strategic action plan to guide restoration efforts over the next decade (<u>CASRI Action Plan</u>). This plan lays out a series of goals, objectives, and key actions that are designed to work toward the CASRI vision. To complement the action plan, CASRI developed a technical document that outlines restoration objectives and methods in various spruce-northern hardwood habitats (<u>Restoration Approach</u>).

2013 proved to be an extremely productive and fruitful year for CASRI, both in terms of funding and on-the-ground restoration work completed. In 2013, CASRI partners raised over 1.2 million dollars for land conservation purchases and restoration projects, adding to the \$888,141 raised in prior years. A total of 62,780 red spruce seedlings and 9331 native plants were planted on over 374 acres. This adds to the 921 acres planted by CASRI partners in the past six years. Moreover, an additional 199 acres of red spruce were selectively released from the understory in hardwood-dominated stands.

This report summarizes the many conservation and restoration activities in which CASRI partners have engaged during the 2013 calendar year. The activities are cross-referenced to the applicable goals, objectives, and key actions from the action plan. The third year of the CASRI Action Plan implementation has manifested a great degree of success. It highlights the importance of forging strong partnerships to aid in building capacity and maintaining momentum in realizing the CASRI vision.

2013 HIGHLIGHTED PROJECTS

VOLUNTEERS LEAD THE WAY IN RED SPRUCE RESTORATION AT CANAAN VALLEY NATIONAL WILDLIFE REFUGE

Every year Canaan Valley NWR selects a new section of the Refuge that will be restored to native red spruce forest. Spring and fall tree planting events have become a tradition on the Refuge. In the past 12 years, more than 68,000 seedlings have been planted on 418 acres. In 2013 alone, 7,800 red spruce seedlings were planted on 57.5 acres.

While these numbers are impressive, it is even more important to note that an enormous amount of volunteer effort made



Volunteers smile for the camera after planting one of the thousands of red spruce seedlings planted at Canaan Valley NWR in 2013.

these plantings possible. Over 1,629 volunteers have assisted with red spruce tree plantings, contributing 27,761 hours of volunteer work. In 2013, 215 volunteers dedicated 663 hours of their time.

Refuge volunteers come from many different places, ages, and backgrounds. With the invaluable

CASRI partners would like to thank our tireless volunteers who continue to support our projects year after year. This restoration effort would not exist without the many hours volunteers commit to CASRI efforts!

CASRI would also like to thank all of the generous organizations that have contributed funding to support conservation and onthe-ground efforts. support and outreach efforts of the West Virginia Highlands Conservancy, we have developed great relationships with local colleges and universities including West Virginia University's Adventure WV program, Student Sierra Coalition, and Freshman Orientation Program; Davis and Elkins College; West Virginia Wesleyan and Potomac State. These colleges and universities now bring the bulk of the volunteers that facilitate our plantings.

However, we can't forget about some of our other dedicated volunteers. They come from many different walks of life, but they believe in the restoration process at the Refuge and come out to help whenever they can. These volunteers include people from the local community, long term volunteers, Friends of the 500th members, Master Naturalists, local elementary, middle and high school

students, Boy and Girl Scouts, other service organizations, people visiting for the weekend, and many more.

These volunteer events are also excellent educational opportunities. While planting red spruce seedlings is in itself very important to the Refuge's overall habitat management goals, we also work to educate our volunteers about red spruce, CASRI, and the larger restoration effort. One of the goals of CASRI is to increase communication, outreach and education on the importance of the red spruce ecosystems. We at the Refuge understand the importance of educating volunteers and we strive to give them a good experience while planting as well as a clear vision of why red spruce restoration is important and how they are helping to make that restoration a reality.

MAINTAINING MOMENTUM ON THE MOWER TRACT: MOVING FROM BARTON BENCH TO LAMBERT

In the late 1980s, the Monongahela National Forest acquired a large tract of land on Cheat Mountain known as the Mower Tract. Prior to the acquisition, almost 2,500 acres had been disturbed by surface mining for coal. Reclamation to federal standards prevented erosion, but left the landscape with heavily compacted soils, altered hydrology, and dense non-native grasses that limited the establishment of native vegetation and trees. Nearly three decades later, many of these 2,500 acres remain as fields of grass, challenging visitors to imagine the high-elevation red spruce-northern hardwood forests that once grew tall upon their hills.

For the past three years, the Monongahela National Forest and CASRI partners have worked to revitalize a 90-acre parcel of land within the Mower Tract known as Barton Bench. With funds provided by the WV-DEP and administered by Canaan Valley Institute, a multifaceted approach was



Aerial imagery of newly scattered coarse woody debris and deep ripped acreage (left of road) at Lambert ecological restoration project area on the Mower Tract (Southwest of Lambert Run).

taken to combat the ecological issues ailing the site. The soils were deep ripped to relieve soil compaction and allow water infiltration to aid plant growth and improve water quality. In addition, nearly 150 wetlands were constructed to improve wildlife and plant habitat and stream water quality. Moreover, 5.25 miles of roads were decommissioned to improve native trout habitat. Finally, over 25,000 red spruce and plants native to high-elevation red sprucenorthern hardwood forests were planted. Having set the groundwork for this site to mature into a fully functioning red sprucenorthern hardwood ecosystem, the Greenbrier Ranger District has now turned its focus to the next phase of the Mower Tract restoration.

Seeking to build upon the successes and taking stock from the lessons learned working at

Barton Bench, we expanded our scientific literature review to diversify our restoration strategy and devise an even more holistic restoration approach. After a long 2012-2013 winter full of planning and preparation, USFS staff, other CASRI partners, and dedicated volunteers took to the Lambert ecological restoration project area to implement a series of on-the-ground improvements. The work that ensued was made possible by funding from the EPA's American Rivers grant program administered by Green Forests Work.

Acknowledging the importance of deep ripping for planting success, over 80 acres were treated. Similarly, an additional 105 sites were prepared as future vernal pools and wetlands. Considering the degraded nature of soils of these mined sites and overall lack of organic matter, 2,070 cubic yards of mulch were secured, free of charge, from the WV Division of Highways' Superstorm Sandy cleanup. This rich source of soil forming organic material was then spread on and tilled into the existing mine soils during the deep-ripping process. Additionally, thousands of non-native trees were knocked down and this woody material was spread across 65 acres of the deep-ripped sites to act as wildlife habitat, microsites for native plant germination, and long-term soil improvement and nutrient sources for plant growth. Finally, 568 aspen were planted to create vigorous early successional habitat for hunters and 750 red spruce treated with beneficial soil fungi to improve plant survival were planted within the Lambert ecological restoration project area. The bulk of our plantings will take place in 2014 with 25,000 red spruce and almost 3000 native perennials slotted to be put in the ground. We will also be spreading locally collected, wet and dry, seed mixes across the site to increase diversity of native plant assemblages. We are all about maintaining momentum on the Mower Tract restoration project and 2013 was no exception.

Thunderstruck: A Major Conservation Win for The Nature Conservancy and CASRI

Since 2007, The Nature Conservancy, the US Forest Service, US Fish & Wildlife Service, and other



Chip Chase, Ben McKeen, and Dave Saville showing off their love of red spruce. With their hard work, TNC planted 34,000 red spruce seedlings in 21 days.

partners have been working together to permanently protect over 2,000 acres of land near Mount Porte Crayon in Randolph County known as the Thunderstruck Tract. Thunderstruck is an ecologically significant property due to its high biodiversity and habitat connectivity. This property buffers the Roaring Plains Wilderness Area of Monongahela National Forest by connecting the high-elevation forests of Roaring Plains to the valley floor along Spruce Run. It creates a north/south link within the Canaan Valley/Dolly Sods landscape to the adjoining Cheat/Spruce Mountain landscape.

The diverse elevation, geology, and climate of Thunderstruck results in outstanding examples of

multiple major forest types, providing habitat for a wide range of plant and animal species, such as the federally-listed Cheat Mountain salamander and the West Virginia northern flying squirrel, as well as critical habitat for many neotropical migratory songbirds, such as the blackburnian warbler. Protection and restoration of this ecological gem continues to be of the highest priority for The Nature Conservancy and CASRI. While this landscape holds significant ecological value, past disturbances resulting in the removal of forest canopy and re-vegetation of openings with grass cover and pine plantations created a need for restoration action.

In May of 2013, The Nature Conservancy, with support of CASRI partners, completed a major restoration project, planting 34,000 red spruce trees – the largest red spruce planting to date in the Central Appalachians! The goals of this project was to increase the extent of habitat for the Cheat Mountain salamander and WV northern flying squirrel, while restoring the landscape context and health to safeguard and enhance the resiliency and adaptive capacity of the species and systems related to the red spruce northern-hardwood ecosystem.

This planting, the first of a three part restoration project funded by a \$250,000 Wildlife Conservation Society grant, is part of a larger effort by CASRI partners to bring back West Virginia's iconic As a direct result of working collaboratively through the CASRI partnership, an incredible \$1,200,577 was raised in 2013, not including in-kind contributions and match! These funds help partners achieve meaningful on-theground restoration at a landscape-level scale. mountaintop forests.

RESEARCHERS IN THE TREES: GETTING SPRUCED UP

CASRI seeks to implement conservation and on-the-ground restoration activities to protect healthy red spruce-northern hardwood ecosystems and to renew the denuded and altered landscapes that historically held these now rare forest types. To ensure that these projects utilize the latest and most accurate science and tools, CASRI partners actively collaborate with and facilitate the scientific studies of researchers who share common interests. The following research synopses are but a small example of the studies being conducted to help CASRI strategize more effective conservation and restoration projects to maximize funding dollars.

Virginia Tech - Corinne Diggins

West Virginia northern flying squirrels (WVNFS) show strong ties to conifer forests, such as spruce, in the Appalachian Mountains. Additionally, the WVNFS is a preferential mycophagist, seeking out the fruiting bodies of underground fungi commonly referred to as truffles. These underground fungi are intrinsically connected to the soils, forests, and mycophagists that consume them. Corinne Diggins, a PhD candidate at Virginia Polytechnic Institute, hypothesizes that the WVNFS selection of



Corinne Diggins has two thumbs and a passion for researching the WV northern flying squirrel, its foraging patterns, and habitat relationships.

foraging sites is related to deep organic horizons characteristic of spruce forests.

Corinne has been working with other Virginia Tech researchers and the USGS Virginia Cooperative Fish and Wildlife Research Unit to investigate WVNFS foraging habitat. Funded through the WVNFS Conservation Fund, Corinne is seeking to elucidate relationships between foraging site structure, composition, and soils to provide a framework to facilitate habitat identification and identify conservation and restoration needs. This link between WVNFS foraging sites, soils, and spruce could help clarify restoration metrics and key forest characteristics that might serve as restoration targets. To understand foraging habitat, Corinne has been capturing, collaring, and tracking WVNFS to foraging locations. Microhabitat is measured at foraging locations to determine characteristics flying squirrels choose at foraging sites. This study is being conducted from 2013 - 2015.

WVU/NRCS - Travis Nauman and Katey Yoast

West Virginia University PhD student Travis Nauman, in coordination with the Monongahela National Forest and the Natural Resources Conservation Service, has been working to understand how conifer-northern hardwood forest communities relate to different soil properties. In a closely related study, WVU master's student and NRCS soil scientist Katey Yoast is quantifying soil organic carbon (SOC) in the Allegheny Mountain. Travis's research focuses on a soil leaching process called podsolization that is characterized by leaching of iron, aluminum, and organic matter from surface to subsurface layers in the soil profile. This process is favored both by acidic, nutrient poor coniferous and ericaceous vegetation along with cool, moist soil environments. This process also sequesters carbon in the soil profile, the subject of Katey's research. Travis and other



Above: Travis Nauman, PhD student at West Virginia University, researches relations between soil properties and forest vegetation.

CASRI partners hypothesize that soils that exhibit this process in the Monongahela National Forest were likely to have had a strong historic red spruce and eastern hemlock presence. Travis has set out to see how the degree of podsolization compares between current occurrence and areas where past logging and fire disturbance caused declines in red spruce forest structure. He expects to find more heavily leached (Podsolized) soils corresponding with the historic distribution of red spruce – hemlock stands. Katey's research, which complements this approach, is expected to find larger amounts of SOC in these podsolized soils.



Above: Katey Yoast, master's student at West Virginia University, is developing a protocol to better quantify soil organic carbon stock.

A goal of the aforementioned research is to create a field scale map of potential historical extent of spruce-hemlock communities based on podzol soil distribution and compare it to other studies and data (e.g. witness trees) for context and validation. The areas identified in this map as historically having more spruce and hemlock could serve as foci of restoration efforts. Of particular interest at these podzol sites is the tendency for soils to form surface and subsurface organic horizons under spruce-hemlock cover.

Many areas denuded of this cover via logging/fire have lost these organic horizons, but they could potentially be reestablished with restoration via red spruce release and planting. This represents an opportunity to sequester (or

re-sequester) significant amounts of carbon while also bolstering habitat for the wide variety of rare and sensitive species in these areas (e.g. Saw-whet owl, northern water shrew, snowshoe hare). Travis and Katey hope to quantify this potential for organic carbon layer restoration under different management scenarios using forest growth and soil evolution models, SOC models, and ecological site descriptions being developed by NRCS.

CASRI ACCOMPLISHMENTS, 2013

The projects highlighted above show some of CASRI's biggest accomplishments for 2013, but those projects comprise only a part of the systematic, landscape-scale restoration effort that CASRI has been pursuing over the last seven years. The following presents a complete summary of accomplishments for 2013 related to key actions, objectives, and goals outlined in the <u>10-year</u> <u>CASRI Action Plan</u>. See the <u>2012</u> and <u>2011</u> CASRI reports for a comprehensive summary of accomplishments for prior years. Highlighting specific achievements by partners engaged in spruce restoration not only helps the initiative see where it has been, but provides direction on the next steps in implementing the plan. Restoration of this size and scope is a long-term commitment to working collaboratively towards common goals and objectives.

GOAL 1. MAINTAIN AND INCREASE OVERALL AREA OF ECOLOGICALLY FUNCTIONING RED SPRUCE COMMUNITIES WITHIN THEIR HISTORIC RANGE.

Objective A. Maintain existing acres of red spruce northern-hardwood communities that reflect natural conditions

Key Actions

I.A.1. Ensure regional land planning efforts by federal and state agencies support conservation of existing red spruce communities.

I.A.2. Provide support for private landowners to maintain and restore existing spruce communities.

Accomplishments

- Canaan Valley National Wildlife Refuge (CVNWR) aided local landowner in planting 100 red spruce seedlings on their property bordering the refuge. The landowner was excited about planting red spruce and is encouraging other nearby land owners. In the long-term, this planting will increase connectivity to spruce planted during CVNWR sponsored tree plantings.
- NRCS administered support through the "Wildlife Habitat Incentive Program" to a private landowner in Randolph County to plant 5,000 red spruce seedlings to continue restoration activities on their property. This is a continuation and final installment of a five-year project to plant 25,000 red spruce seedlings on their property. *For more information, see I.B.4.*

Objective B. Restore identified priority areas to red spruce northern-hardwood communities.

Key Actions

I.B.1. Identify, using latest science and tools, high priority areas for spruce community restoration and conservation. Analysis should include selecting sites by their expected resiliency to changing temperature and precipitation patterns.

Accomplishments

• US Forest Service-Monongahela National Forest (USFS-MOF-Gauley Ranger District) began identifying and reconnoitering prospective sites to begin 1,000 to 5,000 acres of spruce restoration. The Gauley Ranger District contains 15,166 acres of lands assigned to Management Prescription 4.1 (Spruce and Spruce-Hardwood Ecosystem Management) of the MOF Forest Plan.

I.B.2. Identify spruce forest reference conditions for restoration purposes.

Accomplishments

• The reference condition subcommittee prepared a draft document that compiles the known information sources on the pre-disturbance extent, composition, and structure of central Appalachian spruce ecosystems. The document summarizes this information into a consensus CASRI view of reference conditions. During 2014, the subcommittee expects to extend this work into a more clearly articulated set of restoration targets.

I.B.3. Release understory spruce through timber stand improvement techniques such as girdling for gap openings, thinning using commercial timber sales, and herbicide applications to undesirable understory hardwoods.

Accomplishments

- Through funding provided by the Wildlife Conservation Society (WCS), TNC conducted spruce release on 199 acres on Monongahela National Forest lands in the Upper Greenbrier North project area.
- TNC and USFS-MOF are currently identifying an additional 301 acres for additional spruce release within the UGN project area from WCS funding.

I.B.4. Conduct plantings of spruce and other native species associated with spruce communities (as indicated in the National Vegetation Class descriptions).

- Led by TNC, over 34,000 red spruce seedlings were planted across 239 acres on Thunderstruck, near Mount Porte Crayon, Randolph County, WV. See 2013 highlight "Thunderstruck: A Major Conservation Win for The Nature Conservancy and CASRI" and II.G.1for more information.
- With funding provided by Wildlife Conservation Society, TNC planted 4,000 red spruce tree seedlings on 13 acres of private lands at Pharis Knob in the Sinks of Gandy.
- CVNWR staff aided a local landowner in 100 red spruce seedlings on property bordering the refuge. *For further information, see I.A.2.*
- Led by CVNWR staff, 96 volunteers, from West Virginia University (WVU), Potomac State, Davis and Elkins College, WV, Wesleyan College, Master Naturalists and the public, planted 4,000 red spruce seedlings on 31.5 acres on the Caldwell Tract on Bearden Knob in Canaan Valley, WV.
- With CVNWR coordinating, 105 volunteers from WVU, Davis and Elkins College, WV Wesleyan, Cub Scouts, Boy Scouts and the public planted 1,800 red spruce seedlings along a 16 acre section of Sand Run on the Refuge.

- Over 10 volunteers including members of the Wild Turkey Federation and the Ruffed Grouse Society worked to plant over 165 aspen saplings at CVNWR as a part of the refuge's habitat restoration program.
- CVNWR staff led 4 volunteers in planting 200 Canaan Fir seedlings on 2.8 acres underneath an existing stand of Balsam Fir.
- Led by CVNWR staff, 14 volunteers, mostly from Montgomery County Community College, underplanted 2,000 red spruce seedlings on 10 acres along the Blackwater River in Canaan Valley, WV to aid in creating habitat complexity within a site planted with red spruce 10 years prior.
- Canaan Valley State Park planted 100 balsam fir seedlings in an existing fur stand.
- The West Virginia Highlands Conservancy planted 1,000 red spruce seedlings along the access road to the park lodge under-planting dying hemlock stands.
- NRCS administered support to a private landowner in Randolph County to plant 5,000 red spruce seedlings on their property. *For more information, see I.A.2.*
- Canaan Valley Institute, in partnership with the USFS, planted 632 native plants in and around constructed wetlands and vernal pools at Barton Bench.
- Led by USFS-MOF (Marlinton Ranger District) staff, with assistance from the National Civilian Community Corps and AFHA AmeriCorps, planted 2,000 red spruce seedlings and 2,300 native plants at White Low Place along the Highlands Scenic Highway.
- USFS-MOF (Greenbrier Ranger District), AFHA AmeriCorps, and one volunteer who dedicated nearly a week of their time planted 1700 red spruce seedlings along decommissioned roads adjacent Lambert Run.
- USFS-MOF (Greenbrier Ranger District) planted 500 red spruce seedlings over 2 acres in the UGN project area underneath a hemlock stand heavily infested by Hemlock Woolly Adelgid.
- USFS-MOF (Greenbrier Ranger District), AFHA AmeriCorps, and 1 volunteer collaborated to underplant 968 red spruce seedlings over approximately 10 acres within the UGN project area.
- USFS-MOF (Greenbrier Ranger District) and AFHA AmeriCorps AFHA worked to planted 112 red spruce seedlings, 41 balsam fir, and 525 other native plants nearby recently constructed wetland habitat.
- USFS-MOF (Greenbrier Ranger District) planted 2,600 red spruce seedlings over 7 acres of decommissioned roads at Barton Bench.
- USFS-MOF (Greenbrier Ranger District) planted 600 red spruce seedlings over 2.5 acres of decommissioned road in the East Fork Greenbrier River watershed (Road Unk41).
- USFS-MOF (Greenbrier Ranger District) planted 1,000 red spruce seedlings in 5.5 acres of riparian area along Long Run.
- USFS-MOF (Greenbrier Ranger District), with assistance from AFHA AmeriCorps and 6 volunteers, planted 400 red spruce seedlings and 4,800 willow cuttings in 7.7 acre of riparian area along Abes Run.
- USFS-MOF (Greenbrier Ranger District) and AFHA AmeriCorps treated 750 red spruce seedlings with beneficial soil fungi and planted them, along with 250 non-treated red spruce seedlings, over 20 acres within the Lambert ecological restoration project area. *For more information, see 2013 highlight "Maintaining Momentum on the Mower Tract: Moving from Barton Bench to Lambert", II.A.2, and Evan Burks' work in II.A.1.*
- For more information on volunteerism at Canaan Valley National Wildlife Refuge, see

2013 highlight "Volunteers Lead the Way in Red Spruce Restoration at Canaan Valley National Wildlife Refuge".

I.B.5. Support native seed collection and plant/seedling propagation programs to maintain local seed sources and planting stock for projects.

Accomplishments

- Canaan Valley National Wildlife Refuge issued a special use permit to West Virginia Highlands Conservancy to collect native seeds.
- West Virginia Highlands Conservancy volunteers collected seed from 12 different species of native plants. Seeds have been provided to the USFS for seed mixtures to be used in direct seeding. Some seeds have been put into nursery production and some stored for future propagation.
- USFS-MOF, NRCS Alderson Plant Material Center, and AFHA AmeriCorps collected native plant seed on 11 separate occasions to create two separate seed mixes (Wet and dry) to sow after ground disturbance events associated with restoration work (e.g. mechanical preparation and wetland excavation). This included aspen roots and native grass and herbaceous plant seed. In 2013, over 48 lbs. of seed were collected comprising 31 native plant species.

I.B.6. Monitor representative restoration areas to assess whether restored community goals are developing along expected trajectories.

Accomplishments

- TNC began monitoring for tree planting success at Thunderstruck and Pharis Knob.
- The Monongahela National Forest established baseline-monitoring plots in a noncommercial spruce restoration unit and a control unit in the Upper Greenbrier North project area. These plots will track changes in vegetation species composition and structure over time.
- The USFS-MOF (Greenbrier Ranger District) established and collected data from 34 monitoring plots within the Lambert ecological restoration project area. Plots were situated within restoration treatments spanning areas of coarse woody debris and mulch loading, forest gap creation, deep ripped soils, wetlands and vernal pools, early succession habitat plantings of aspen and red spruce, and seedlings inoculated with ectomycorrhizal fungi.
- The USFS-MOF (Greenbrier Ranger District) established and collected data from 31 monitoring plots on Barton Bench, a former mine site that was mechanically treated and planted in 2011.

Objective C. Protect land suitable for red spruce northern-hardwood communities, or identified as wildlife habitat corridors or forest connectors.

Key Actions

I.C.1. Purchase acreage of red spruce communities through fee acquisition from willing sellers.

 Through funds provided by the Outdoor Heritage Conservation Fund, TNC was awarded \$484,942 for the purchase of fee acquisition from 2 willing sellers in lands adjacent to public lands near Mount Porte Crayon. This funding, received in 2013, will secure an additional 218 acres of high-elevation red spruce/northern hardwood habitat in perpetuity.

I.C.2. Pursue management agreements and conservation easements with private landowners.

Accomplishments

- Through funding provided by the Outdoor Heritage Conservation Fund, TNC was awarded \$190,855 for the purchase of a conservation easement on Pharis Knob. This is in addition to funding received through the American Rivers-EPA grant awarded in 2012. This easement was pursued to protect and restore lands shown to harbor high resiliency and adaptive capacity in the Central Appalachians.
- Through funding awarded through the West Virginia Northern Flying Squirrel Fund, TNC received \$470,000.00 for purchase of conservation easement, due diligence, and lasting endowment of lands on Pharis Knob.

I.C.3. Encourage use of programs established by the Clean Water Act, Clean Air Act, Farm Bill and other legislation to support private landowners interested in red spruce restoration.

Objective D. Map and quantify the size and configuration of spruce and spruce-northern hardwood forests at regular intervals to assess temporal changes in the overall extent of these habitats across the landscape.

Key Actions

I.D.1. Delineate the extent of existing red spruce stands at a scale of 1:24,000 through current, high resolution air photo interpretation, plot data and modeling. Validate this map via ground truth control points.

Accomplishments

- Validation of 15,490 GIS polygons covering 1.3 million acres in the Allegheny Mountains of West Virginia was completed with the help of multiple CASRI partners (WVDNR, USFS, USFWS – WVFO, and AFHA AmeriCorps).
- The red spruce cover map of West Virginia, displaying overstory red spruce at various densities (High (>50%), medium (10 50%), or trace (10% or less)) has been completed. This was a multi-partner endeavor led by the WVDNR. The red spruce map can be viewed at <u>www.restoreredspruce.org</u> under the "Research" heading. Access the spruce cover data at <u>wvgis.wvu.edu/data/dataset.php?ID=455</u>.

I.D.2. Update mapping developed in Key Action 1, using the latest imagery available, on a regular basis to assess changes in the quantity, size and configuration of spruce communities across the landscape.

GOAL II. INCREASE THE BIOLOGICAL INTEGRITY OF EXISTING RED SPRUCE NORTHERN-HARDWOOD COMMUNITIES.

Objective A. Improve red spruce northern-hardwood community structure and species composition across the Central Appalachian landscape.

Key Actions

II.A.1. Support research to understand significant ecological relationships within spruce communities.

Accomplishments
CASRI members at the USFS-NRS and WVU are involved in two research studies
investigating red spruce northern-hardwood community structure and species
composition in the short and long term and at stand and landscape level.
\circ One study involves direct manipulation of red spruce-northern hardwood
stands through thinning to document the response in species composition
and stand structure to restoration treatments.
 Spruce release plots were re-measured at Kumbrabow State Forest,
Canaan Valley NWR, and the Gauley Ranger District (MOF).
 Canopy imagery was captured again and analyzed for all
measurement periods, starting in 2007.
 Analysis of the degree of release in this pilot study with take place
in 2014.
• The second study uses a landscape-scale model to simulate management
alternatives for restoration of spruce-dominated forests for 100 years
from real stand data.
 USFS-MOF, WVDNR, and USFWS collaborated with researchers (Virginia Polytechnic
Institute) to document foraging and denning habits of the West Virginia northern
flying squirrel.
• USFS-MOF, WVDNR, and the Friends of Blackwater are collaborating with researchers
from Purdue University and the Institute of Arctic Biology, University of Alaska to
assess the use of hair snare traps as a non-invasive method of documenting WV
northern flying squirrel presence as well as acquiring hair samples for analysis.
Purdue researchers will collect WVNFS hair and fecal samples, along with data
regarding food availability across the landscape, to determine diet items consumed
by WVNFS using stable isotope and fecal analyses.
• The USFS-MOF is collaborating with Marshall University to collect soil samples in
study areas used for a Cheat Mountain salamander study (part of a Participating
Agreement) conducted recently across the species' range on the Monongahela NF. Soil
characteristics including pH will be analyzed in conjunction with amphibian survey

sympatric species.
 Travis Nauman, Ph.D candidate at WVU, completed his summer field work for his dissertation entitled: *Digital Modeling of Soil Survey and Ecological Sites for Field Scale Conservation Planning*. He completed 63 fixed area plots that have full soil and vegetation characterization in the Appalachian Highlands Red Spruce Ecosystem. Travis gave a seminar presentation and is scheduled in 2014 to give his presentation

data to assess the relationship between soils and the occurrence of CMS and

to the USFS-MOF. See 2013 highlight "Researchers in the Trees: Getting Spruced Up" for further information.

- Corinne Diggins, Ph.D candidate at Virginia Tech, is conducting research on "<u>WV</u> <u>Northern Flying Squirrel Foraging Sites: Relating Structure, Composition, and Soils to</u> <u>Habitat Identification, Conservation, and Restoration Needs</u>." Corinne spent much of her 2013 summer field season trapping, collaring, and tracking WV northern flying squirrels to foraging locations. Microhabitat was measured at foraging locations to determine characteristics flying squirrels choose at foraging sites. This study is ongoing and will be completed in 2015. *See 2013 highlight "Researchers in the Trees: Getting Spruced Up" for further information.*
- Evan Burks, M.S. student at Green Mountain College in Poultney VT, finished setting up his field study to determine the importance of ectomycorrhizal inoculation on the growth and survival of planted red spruce seedlings. Evan spent the 2013 field season collecting native soil from red spruce forests and native ectomycorrhizal fungi from a variety of forest types. The study attempts to clarify the importance of ectomycorrhizal fungi in spruce plantings by treating red spruce seedlings with a control, a native soil wash (which includes native fungal spores and soil bacteria), fungal spores, or a commercially available inoculant of a locally available species. Evan will return in 2014 to re-measure the planted red spruce.

II.A.2. Implement restoration projects that include native plantings, overstory thinning, gap creation, snag creation, coarse woody debris creation, and spruce release.

Accomplishments

- USFS-MOF with the aid of the Office of Surface Mining, Green Forest Works, Ridgewater LLC, Union Concrete, WVDNR, and AFHA AmeriCorps implemented various restoration treatments on approximately 101 acres of previously reclaimed mined land within the Lambert ecological restoration project area.
 - Mechanically prepared (deep ripping) heavily compacted soils of approximately 80 acres.
 - Scattered coarse woody debris across approximately 65 acres of the mechanically prepared project area.
 - Built 105 perennial or seasonal wetlands.
 - Created three $1/5^{\text{th}}$ acre forest gaps.
 - Planted 568 aspen trees to expedite the creation of early successional habitat.
 - Inoculated 750 red spruce seedlings with locally collected ectomycorrhizal fungi to expedite their growth and increase survival during plant establishment. These seedlings, along with 250 uninoculated red spruce seedlings, were planted at the restoration site.
 - For more information, see 2013 highlight "Maintaining Momentum on the Mower Tract: From Barton Bench to Lambert".
- See I.B.3 for additional information on spruce release projects
- See I.B.4 for additional information on native planting projects

II.A.3. Monitor development of ecosystem species composition and structure including snags and coarse woody debris.

• See I.B.6 for further information on monitoring of restoration treatments.

Objective B. Reduce and prevent forest fragmentation.

<u>Key Actions</u>

II.B.1. Identify threatened areas of highest priority for red spruce community restoration.

Accomplishments

• The article "Using maximum entropy modeling to identify and prioritize red spruce forest habitat in West Virginia" was published by Nathan Beane of the US Army Research and Development Center, Jim Rentch of WVU, and Tom Schuler of the USFS-NRS.

II.B.2. Prioritize these threatened areas for conservation action.

II.B.3. Engage industry partners when possible to limit impacts on core forest habitat.

Accomplishments

• TNC is engaging in mapping of critical habitats to inform conservation and development decision making.

II.B.4. Increase road decommissioning projects.

Accomplishments

- USFS-MOF (Greenbrier Ranger District) decommissioned 5.5 miles of road in the Fivemile Hollow watershed.
- USFS-MOF (Greenbrier Ranger District) decommissioned 5.7 miles of road in Span Oak Run watershed of the Upper Greenbrier North project area.

II.B.5. Develop cross-partnership Best Management Practices for limiting fragmentation.

Objective C. Restore connectivity between existing red spruce northern-hardwood communities.

<u>Key Actions</u>

II.C.1. Increase patch sizes of red spruce communities across the landscape to enhance ecological function.

Accomplishments

See I.B.3 and I.B.4, spruce release and native plantings.

II.C.2. Identify key areas for connectivity between spruce forests across the Central Appalachians. Strive to preserve and increase connected north-south and elevation gradients.

II.C.3. Implement restoration activities on lands identified as key connectors.

Accomplishments

• Began implementation of Pharis Knob restoration project by planting 4,000 red spruce seedlings across 13 acres on private lands that bridge two large publicly owned landscapes, Laurel Fork Wilderness Area and Seneca Rock Spruce Knob Recreation Area. *For more information, see also I.C.2.*

II.C.4. Increase easements and acquisition of lands identified as key connectors.

Accomplishments

• Purchase of 555 acre conservation easement on Pharis Knob acts to connect two 100,000 plus acre landscapes, Laurel Fork Wilderness Area and Seneca Rocks Spruce Knob Recreation Area. *For more information, see also I.C.2.*

Objective D. Manage non-native invasive species infestations in red spruce northernhardwood communities.

Key Actions

II.D.1. Develop and implement effective, safe, and environmentally sound restoration for weed-infested areas.

Accomplishments

- The Barton Bench ecological restoration project received support for a third year through the Potomac Highlands Cooperative Weed and Pest Management Area's seasonal "Ecosystem Support Team" invasive species treatment crew, under TNC supervision. The team worked for four days to treat 90 acres at the restoration sites on Cheat Mountain to manage existing populations of invasive plants in spruce planting areas
- USFS-MOF (Greenbrier Ranger District) treated 25 acres at Cunningham Knob for meadow knapweed to prevent spreading into valuable spruce habitats.
- The Potomac Highlands CWPMA's Ecosystem Support Team, under TNC supervision, treated spotted knapweed across 129 acres on Barton Bench and Lambert Strip as part of the larger restoration objectives on Cheat Mountain.
- The CWPMA, under TNC supervision, treated 11 acres of garlic mustard along Forest Road 112 East of Spruce Knob.
- For the ninth consecutive year, USFS-MOF hand-pulled garlic mustard from the Gaudineer Scenic Area old growth spruce stand. After years of diligent efforts to exhaust the seed bank, the infestation is approaching eradication.

II.D.2. Apply Best Management Practices for preventing the spread of non-native invasive species in all project areas.

Accomplishments

• USFS-MOF (Greenbrier Ranger District) applied clean equipment BMPs to all grounddisturbing work on the Lambert ecological restoration project.

• USFS watershed enforced BMPs requiring heavy equipment cleaning prior to arrival onto National Forest System lands for watershed restoration activities.

II.D.3. Encourage and promote local nurseries to grow native plant species for planting.

Accomplishments

- The NRCS (Alderson Plant Materials Center) and the WV State nursery continued to work with the USFS-MOF, USFWS-CVNWR, and other partners to provide native plant material for ecosystem restoration efforts. Over 1,100 native plants from Alderson PMC were planted on the Lambert Strip, part of the Lambert ecological restoration project, through this partnership.
- The NRCS (Alderson Plant Materials Center) assisted USFS-MOF by transferring and providing growing space for 1,000 red spruce seedlings in preparation for an ectomycorrhizal inoculation study.
- Tucker County High School Greenhouse has been working with Refuge biologists to begin growing native plants including red spruce. The Refuge gave the greenhouse 500 red spruce seedlings for them to begin growing and will later be planted on the Refuge.
- The WV Division of Forestry's Clements State Tree Nursery grew native woody plants from seeds collected by the WV Highlands Conservancy.

II.D.4. Provide information about potential non-native invasive threats.

II.D.5. Monitor restored sites for new infestations of invasive species.

Accomplishments

- Long-term invasive species routes at CVNWR were monitored for invasive species.
- USFS-MOF continued monitoring of the Barton Bench ecological restoration area.

Objective E. Restore or improve forest hydrology, wetlands and streams associated with red spruce communities in the Central Appalachians.

Key Actions

II.E.1. Protect and restore wetlands within the spruce zone to enhance ecological services and biodiversity.

Accomplishments

- USFS-MOF (Greenbrier Ranger District) created ephemeral wetlands at appropriate locations as part of road decommissioning efforts and floodplain enhancements using large wood in the Upper Greenbrier North project area.
- USFS-MOF (Greenbrier Ranger District) constructed 105 wetlands and vernal pools to utilize rain events to enhance biodiversity within and surrounding the Lambert ecological restoration project area. *For further information, see II.A.2.*

II.E.2. Protect streams and wetlands by insuring buffers are in place during silvicultural restoration work.

II.E.3. Maintain buffers along headwater and other streams by planting unforested riparian areas and protecting existing ones.

Accomplishments

- 105 volunteers planted 1,800 red spruce seedlings along a 16 acre section of Sand run at CVNWR to provide forest cover that does not currently exist. This stream is a major tributary of the Blackwater River. *For further information, see I.B.4.*
- 14 volunteers planted 2,000 red spruce seedlings on 10 acres along the Blackwater River in Canaan Valley, WV to provide cover that does not currently exist. *For further information, see I.B.4.*
- USFS-MOF planted 4,800 willow cuttings and 400 red spruce seedlings along Abes Run to shade waters that feed into the headwaters of the east fork of the Greenbrier. *For further information, see I.B.4.*
- USFS-MOF planted 1,000 red spruce seedlings in 5.5 acres of riparian area along Long Run. *For further information, see I.B.4.*

II.E.4. Reduce overland flow by supporting watershed restoration efforts designed to restore more natural hillslope drainage patterns and processes, reduce soil loss/erosion (including hillslope and stream bank stabilization), and increase soil productivity.

Accomplishments

- Restoration treatments at the Lambert ecological restoration project area will act to reduce overland flow by allowing greater water infiltration, increasing soil productivity, and utilizing water from rain and snow events. *See II.A.2 and 2013 highlight "Maintaining Momentum on the Mower Tract: Moving from Barton Bench to Lambert" for further information on restoration treatments.*
- USFS-MOF (Greenbrier Ranger District) decommissioned a total of 11.2 miles of road in the Fivemile Hollow and Span Oak run watershed. These projects improve watershed quality by increasing water infiltration which acts to reduce overland flow and soil erosion. *For further information, see II.B.4.*
- USFS-MOF implemented a series of restoration and remediation activities of a former mine site adjacent to Tub Run to restore hillslope and improve upon water quality. *See II.E.5 for further information.*

II.E.5. Support projects that remediate acid mine drainage.

Accomplishments

• USFS-MOF implemented a series of remediation activities adjacent to Tub Run to improve water quality metrics. The work, occurring over 77 acres, was designed to provide positive drainage into channels to limit acidification of water flowing into Tubs Run. Over 12,000 lineal feet of drainage channels and approximately 10,000 lineal feet of constructed access road was surfaced with limestone. Testing of pH values have observed an increase of pH from 4.66 to values ranging between 5.52 and 6.67. Water quality levels are expected to continue to improve with time as sod and other site features develop. *See II.E.4 for further information.*

Objective F. Support an understanding of biological and chemical soil processes.

Key Actions

II.F.1. Support research to address acid deposition and soil/stream acidification on poorly buffered geologies typical under high-elevation spruce communities.

Accomplishments

- The USFS-MOF soil scientist gave several graduate level presentations on Red spruce restoration and associated spodols and spodic dystrudepts entitled: <u>Monongahela</u> <u>National Forest: Soil Survey Updates in the Red Spruce Ecosystem New Interpretations</u>. This same presentation was given to researchers at the Northeastern Soil Monitoring Cooperative in Troy, NY (hosted by USGS).
- NRCS updated over 89,000 acres on federal land for both soil survey and for Ecological Site Inventory. This effort resulted in the development of two new Red Spruce ESDs.
- NRCS, in cooperation with USFS-MOF collected data on soil morphology, vegetation, and site characteristics at 316 field plots to support the soil survey update and ESD development. Full laboratory characterization, including both chemical and physical analyses, was completed on 7 pedons formed under a dominant or co-dominant red spruce canopy from materials weathered from the Chemung and Hampshire Formation bedrocks. This data provides a greater understanding of the soil forming processes at work in red spruce ecosystems, the resultant changes in soil morphology and chemistry, and the limitations and management concerns of these soils.

II.F.2. Support research that addresses deposition of other atmospheric pollutants (e.g. mercury) on high-elevation mountains in Central Appalachians.

Accomplishments

- The USFS-MOF incorporated sampling dissolved organic carbon in approximately a dozen streams as part of its biannual stream chemistry-monitoring program this FY. Literature has shown that DOC can be used as a surrogate for methyl Hg levels in stream water. This monitoring is new and a major milestone in adapting a new water quality parameter for monitoring in that DOC can be used as a surrogate for tracking multiple watershed responses.
- The USFS-MOF seeks to partner with the USFS-NRS in future monitoring efforts to expand the number of samples and watersheds as part of the program.

II.F.3. Support research for understanding soil carbon relationships with conifer forests.

- Katey Yoast, master's candidate at WVU, is currently working on completing her master's thesis entitled: <u>Digital Modeling of Soil Organic Carbon in the Eastern</u> <u>Allegheny Plateau and Mountains Using Legacy Data</u>. In 2013, she presented at the NRCS-USFS-WVU annual soil field week for soil survey update, analyzed Rapid Carbon Assessment samples by dry combustion, and gathered available laboratory and spatial data to model soil organic carbon. She is expected to complete her thesis in May of 2014.
- The USFS-MOF continues to work with NRCS and collect its own soil carbon numbers

to complete a basic assessment for soil carbon storage numbers.

• USFS-MOF is working with CASRI partners to incorporate soil management and protection into future restoration efforts in the red spruce ecosystem.

II.F.4. Support monitoring of biological soil quality in existing red spruce communities.

Accomplishments

- As part of the Lambert ecological restoration project, wood chips were incorporated into the soil restoration work on existing reclaimed mine lands as part of the deep ripping. Organic matter additions were mixed into the deeply ripped channels. Monitoring by USFS-MOF of soil quality parameters such as friability, tilth, and structure is set to take place in spring of 2014.
- As part of a participating agreement, the USFS-MOF is collaborating with Marshall University to collect soil samples for soil characteristic analysis. *For further information, see II.A.1*.

Objective G. Support development of spruce communities more resilient to average and seasonal temperature and precipitation changes over the next 50 years.

Key Actions

II.G.1. Preserve and increase connected north-south and elevational gradients through acquisition, easements, and implementation of restoration actions.

Accomplishments

• TNC planted 34,000 red spruce seedlings on Thunderstruck that has been identified as a priority landscape for its landscape complexity and elevational connectivity. For further information, see I.B.4 and 2013 highlight "Thunderstruck: A Major Conservation Win for The Nature Conservancy and CASRI".

II.G.2. Identify and prioritize restoration sites by their resiliency to changing temperature and precipitation patterns.

GOAL III. PROTECT HABITAT FOR KEY WILDLIFE SPECIES AND COMMUNITIES TO PROMOTE BIODIVERSITY.

Objective A. Provide functional habitat for species dependent on red spruce ecological systems.

Key Actions

III.A.1. Identify and prioritize focal species associated with red spruce communities and their key habitat requirements.

Accomplishments

• Corinne Diggins, Virginia Tech PhD student, completed her 2013 field to address the topic "<u>WV Northern Flying Squirrel Foraging Sites: Relating Structure, Composition</u>,

and Soils to Habitat Identification, Conservation, and Restoration Needs." See II.A.1 and 2013 highlight "Researchers in the Trees: Getting Spruced Up" for further information.

III.A.2. Support research to determine minimum patch sizes necessary to supply habitat to maintain viable populations of rare species.

Accomplishments

• The WVDNR and USFWS – WVFO jointly provided funding to the University of North Carolina to conduct a genetic evaluation of Cheat Mountain salamander populations. This study will help evaluate current gene flow between populations and assess the effects of habitat fragmentation. Genetic samples were previously collected by WVDNR, USFWS (WVFO and CVNWR), and Marshall University staff.

III.A.3. Support implementation of recovery action plans and conservation strategies for threatened, endangered, and sensitive species associated with red spruce ecosystems.

Accomplishments

• CVNWR is continuing recovery actions (monitoring) for both WV northern flying squirrel and Cheat Mountain salamander. *For further information, see III.B.I.*

III.A.4. Identify and prioritize targeted acquisitions and specific management actions for priority habitat areas.

Objective B. Establish adequate inventory and monitoring for key wildlife species.

Key Actions

III.B.1. Identify populations of key species in existing habitat and areas undergoing restoration treatments.

- WVDNR conducted annual monitoring of WV northern flying squirrel nest boxes. A highlight of this activity was the confirmation of occupied habitat at the type locality in the North Fork of the Cranberry River, which had not been surveyed since the 1930's.
- CVNWR is continuing recovery actions (monitoring) for both WV northern flying squirrel and Cheat Mountain salamander.
- USFS-MOF conducted annual monitoring of WV northern flying squirrel nest boxes. After several years of few to no captures across the Forest's nest box grids (zero capture across 20 sites in 2010 or 2011), 2011-2013 surveys resulted in captures at several locations, including three new long-term sites established in 2010.
- WVDNR and USFWS supported field surveys by Marshall University researcher Dr. Tom Pauley to re-visit sites surveyed 10 or more years ago and re-sample Cheat Mountain salamander populations using the same methods used in the original surveys.
- The USFS-MOF is continuing annual monitoring of Cheat Mountain salamander

survey locations established as part of a Participating Agreement with Marshall University in 2008. Only a small subset of the sites could be sampled in 2013 due to a lack of field personnel, but several CMS were observed and two CMS nests were found under cover boards. *For further information, see II.A.1.*

- WVDNR contracted with the University of North Carolina at Wilmington to begin a 2 ¹/₂ year population genetics study of the Cheat Mountain salamander.
- Dr. Stephen Keller of Appalachian Laboratory at the University of Maryland continued his research on the genetic variation in red spruce in West Virginia.

III.B.2. Identify specific habitat conditions for species of concern associated with spruce-northern hardwood communities.

Accomplishments

- PhD candidate Corinne Diggins of Virginia Tech collaborated with CASRI partners to conduct her 2013 field research to help address "<u>WV Northern Flying Squirrel</u> <u>Foraging Sites: Relating Structure, Composition, and Soils to Habitat Identification, Conservation, and Restoration Needs.</u>" See II.A.1 and 2013 highlight story "Researchers in the Trees: Getting Spruced Up" for further information.
- Marshall University, in collaboration with the USFS-MOF, is collecting soil samples for the purpose of identifying relationships between soil characteristics and the occurrence of Cheat Mountain salamander habitat. *See II.A.1, II.F.4, and III.B1 for further information.*

III.B.3. Evaluate existing species monitoring protocols and implement new approaches when necessary.

III.B.4. Support agencies that are conducting monitoring actions, and integrate monitoring data into future restoration strategies.

III.B.5. Develop agreements with landowners to permit monitoring actions on private land.

GOAL IV. INCREASE COMMUNICATIONS, OUTREACH AND EDUCATION ON THE IMPORTANCE OF THE RED SPRUCE ECOSYSTEMS.

Objective A. Develop and distribute communication tools for targeted audiences.

<u>Key Actions</u>

IV.A.1. Create targeted audience outreach plan that will include producing brochures and maps.

- Through a collaborative effort led by TNC, USFWS, USFS, WVHC, and CVNWR, a comprehensive CASRI Communications Plan has been completed. This plan outlines key messages, targeted audiences, tactics and channels for reaching targeted audiences, as well as a worktable for implementing communication objectives.
- CASRI Partners developed a Facebook page for expanding social media reach. The page has 245 fans as of 12/31/2013.
- TNC featured the Thunderstruck planting of 34,000 red spruce trees in its national

magazine.

- A story on delisting of the flying squirrel and CASRI's red spruce restoration efforts was pitched to TNC's national magazine. A writer and photographer spent 4 days in the field with CASRI partners in the fall of 2013 documenting CASRI's restoration efforts. This will be featured in TNC's national magazine in spring 2014.
- An article on CASRI's cooperative conservations efforts and their contribution to the recovery of the West Virginia northern flying squirrel was published in the USFWS's national publication, the Endangered Species Bulletin. The article was drafted by USFWS-WVFO/AmeriCorps staff.
- CASRI's cooperative conservation efforts were highlighted to the USFWS National Directorate in a poster presented during a meeting on Landscape-scale Conservation Partnerships. The poster was developed by USFWS (CVNWR and_WVFO) and TNC staff.
- USFS-MOF collaborated with the USFWS-NCTC's Creative Imagery Team to create three video clips to describe the restoration work occurring on the Mower Tract.
 - i. Spruce reforesting short: <u>http://bcove.me/tdb781dn</u>
 - ii. Spruce reforesting long : <u>http://bcove.me/dq4bncc9</u>
 - iii. Spruce and climate change: <u>http://bcove.me/51gb50ll</u>

IV.A.2. Launch website containing information about restoration initiative, financial support needed and progress towards accomplishing key actions.

Accomplishments

• Maintained the CASRI website at <u>www.restoreredspruce.org</u>. This includes current calendar, news items, ecology, history, research as well as current CASRI documentation such as meeting agendas and minutes, reports, and planning documents.

IV.A.3. Increase educational outreach through volunteer recruitment and programs.

Accomplishments

• CVNWR and the WVHC organized volunteer red spruce planting events with Adventure WVU, WVU Sierra Club, Potomac State College, WV Wesleyan College, Montgomery Community College and Davis & Elkins College. Students were educated about the Refuge, CASRI, and the restoration efforts. *For further information, see* 2013 highlight "Volunteers Lead the Way in Red Spruce Restoration at Canaan Valley National Wildlife Refuge".

IV.A.4. Provide landowners with informational materials about Farm Bill programs and conservation opportunities for improving spruce habitat.

Objective B. Foster information and resource sharing culture with conservation professionals.

Key Actions

IV.B.1. Develop a red spruce learning network and information forums.

Accomplishments

- WVDNR presented highlights of the work of the CASRI partnership at the Ecological Society of America Annual Meeting and at "Connect, Collaborate, and Conserve in an Era of Changing Landscapes" at the National Conservation Training Center.
- WVDNR led field trips and gave presentations on the red spruce ecosystem to graduate students from West Virginia University and University of North Carolina, and to the public including the Audubon Society, Brooks Bird Club, West Virginia Native Plant Society, Virginia Native Plant Society, and Soil and Water Conservation Society.
- See II.F.1, USFS-MOF soil scientist delivered several graduate level talks entitled: <u>Monongahela National Forest: Soil Survey Updates in the Red Spruce Ecosystem - New</u> <u>Interpretations.</u>

IV.B.2. Identify key research needs for the restoration of red spruce communities and develop a collaborative approach to obtaining the answers.

GOAL V. INCREASE CAPACITY AND INSTITUTIONALIZE COORDINATION OF RED SPRUCE RESTORATION EFFORTS TO EXPAND IMPLEMENTATION OF KEY ACTIONS.

Objective A. Integrate action plan for the restoration of red spruce communities into local, state, and regional plans.

Key Actions

V.A.1. Engage multi-state partners to develop a network of restoration sites across the Central Appalachian landscape.

V.A.2. Work with partners to implement state wildlife action plans and other land management plans which focus on spruce/northern hardwood species management.

V.A.3. Integrate multi-state partners into the Appalachian Landscape Conservation Cooperative and other regional ecological planning teams.

Accomplishments

- USFS- MOF and TNC worked closely with the Appalachian Landscape Conservation Cooperative to develop a CASRI workspace on the LCC website for deeper integration with the LCC and for housing important files for the group.
- TNC and USFS is working closely with TNC, USFS, the North Carolina Wildlife Resource Commission, and other representatives in Tennessee and North Carolina, exporting the CASRI model of cross-boundary, multi-partner collaboration. Through this engagement, SASRI, the Southern Appalachian Spruce Restoration Initiative has been created.
- In 2013, TNC and the Southern Highlands Reserve signed an MOU in collaboration to restore red spruce.

V.A.4. Support an increase in adequate funding levels for restoration projects by all land managing partners.

Accomplishments

- The USFS-MOF in partnership with CVI was awarded \$50,000 by Appalachian Stewardship Foundation to implement restoration activities in the Lambert ecological restoration project area.
- See I.C.I, Outdoor Heritage Conservation Fund awarded TNC \$484,942.00 for the purchase of fee acquisition of lands near Mount Porte Crayon.
- See I.C.2, TNC was awarded \$190,855 by the Outdoor Heritage Conservation Fund for the purchase of a conservation easement on Pharis Knob.
- See I.C.2, TNC received \$470,000.00, through the West Virginia Northern Flying Squirrel Fund, for the purchase of conservation easement, due diligence, and lasting endowment of lands on Pharis Knob.

V.A.5. Support allocation of resources for CASRI coordinator position, key staff and partner organizations.

Accomplishments

• TNC and USFS-MOF continued to provide financial support for the CASRI coordinator position. Although the position was vacated in late 2013, USFS, TNC, USFWS, WVDNR, and other partners are discussing a strategy for funding and filling the position in the near future.

Objective B. Evaluate outcomes for all key actions outlined in this plan.

Key Actions

V.B.1. Support resource allocation for monitoring and evaluation of all restoration areas.

V.B.2. Develop plan for sharing best evaluation methodologies and data locally and across the Central Appalachians.