
CASRI
The Central Appalachian
Spruce Restoration Initiative

TABLE OF CONTENTS

2014 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

(CASRI Action Plan). 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 (Restoration Approach).

2014 proved to be an extremely productive and fruitful year for CASRI, both in terms of funding and on-the-ground restoration work completed. In 2014, CASRI partners raised over $896,000 for land conservation purchases and restoration projects, adding to the $2,088,141 raised in prior years. A total of 58,000 red spruce seedlings and 39,575 native plants were planted. Over 750 acres of high-elevation lands placed on a trajectory to develop into functioning red spruce ecosystems, bringing our restoration total to nearly 2,250 acres!

This report summarizes the many conservation and restoration activities in which CASRI partners have engaged during the 2014 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.

The Central Appalachian Spruce Restoration Initiative

Protecting One of the Central Appalachian's Most Unique Ecosystems: 2014 Highlights

Year-End Review

We are pleased to share highlights of the Central Appalachians Spruce Restoration Initiative!

CASRI is a diverse partnership of private, state, federal, and non-governmental organizations who share a common goal of restoring historic red spruce-northern hardwood ecosystems across the Central Appalachians.

CASRI's vision is of 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.

Ben Rhodes cheerfully pulls invasive garlic mustard with the Potomac Highlands CWPMA field crew.

Ashley Akers, AmeriCorps member of the Ecological Restoration Team, plants a red spruce seedling.

Major Highlights

2014 proved to be another extremely productive and fruitful year for CASRI:

- Over $896,000 for land conservation purchases and on-the-ground restoration projects in 2014, totaling $2,984,141 raised to date.
- Over 750 acres of high-elevation lands placed on a trajectory to develop into functioning red spruce ecosystems, bringing our restoration total to nearly 2,250 acres.
- 58,000 red spruce seedlings and 39,575 native plants were planted upon high priority conservation and restoration sites.
- Volunteers dedicated 461.5 hours of their time working to restore red spruce.
- Over 600 acres of non-native invasive species were treated in high-elevation red spruce systems.
- The monitoring subcommittee developed and finalized a rapid assessment monitoring datasheet, protocol, and Access database for red spruce plantings and sites for use in future monitoring.

Several of CASRI's partners are engaged in spruce release. At left, a gap created by commercial spruce release at Kumbrabow SF promotes growth of mid-story spruce into the canopy.
On the right, the TNC field crew girdles a neighboring maple to release a young spruce tree. The trees girdled are selected based on factors, such as abundance and wildlife use.

Research

The research done by CASRI partners leads to a better understanding of the ecological relationships within spruce communities. This year, our partners released research on a diverse range of topics:

- **Corinne Diggins** (Virginia Tech) conducted a microhabitat assessment for WV northern flying squirrels using telemetry data.
- **Brandon Davis** (NC State University) tracked snowshoe hares to study the relationship between color change and weather patterns.
- **Melissa Thomas-Van Gundy** used the landscape scale model LANDIS-II to simulate the response of red spruce-dominated forests to restoration actions over 100 years.
- **Jim Rentch** and others presented 6 year results of understory red spruce release.
- **West Virginia Restoration Venture (USFS, WVU, NRCS)** gave grad level presentations on restoration and associated spodosols, based on research by **Travis Nauman. Katey Yoast** published carbon estimates for above ground and below ground systems. This data shows that the red spruce ecosystem has tremendous carbon sequestration potential.

Heads in the Trees, Feet on the Ground

CASRI hit the ground running this year, carrying out a broad array of restoration projects:

- The **Canaan Valley National Wildlife Refuge** brought 104 volunteers to the Refuge during volunteer events who planted 8,300 red spruce seedlings on 82 acres. These events are used to achieve restoration objectives and educate volunteers about the importance of spruce ecosystems and restoration.
- **The WV Division of Forestry – Kumbrabow State Forest** released 50 acres of red spruce through commercial timber harvest, established four permanent spruce research plots with pre-harvest baseline data, created 25 vernal pools/wetland areas within the commercial release plots, and hosted an Active Spruce Restoration Field Tour for CASRI partners. Additionally, **The Nature Conservancy,** working with Dave Saville, released a total 472 acres of understory spruce in the Greenbrier River watershed.
- **The Nature Conservancy** planted 35,000 red spruce seedlings and 14,000 northern hardwood seedlings across 186 acres of the Pharis Knob/Gandy Ranch conservation easement and 7 acres of adjacent USFS land, for a total 193 acres. The **Potomac Highlands CWPMA Field Crew**, which is employed by TNC, treated 576 acres of invasive species in and around red spruce-northern hardwood forests.

CASRI would like to thank the following organizations that have contributed funding to support conservation and on-the-ground efforts in 2014:

Appalachian Stewardship Foundation
Arbor Day Foundation
Environmental Protection Agency: American Rivers Grant
Ohio River Basin Fish Habitat Partnership
Outdoor Heritage Conservation Fund
U.S. Forest Service and NRCS Chiefs' Joint Landscape Restoration Partnership
West Virginia Department of Environmental Protection
Wildlife Conservation Society

To learn more about CASRI and view the complete 2014 annual report, visit:
http://RestoreRedSpruce.org

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.

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

- **Completion of Ecological Site Descriptions *(see II.B.1)***

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

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

- **Kumbrabow State Forest released 50 acres of red spruce through commercial timber harvest spread over 3 separate areas.**
- **The Nature Conservancy, through funding provided by the Wildlife Conservation Society's Climate Adaptation Fund released 350 acres of understory red spruce in the Greenbrier River watershed within the Upper Greenbrier North project Area on the Greenbrier District of the Monongahela National Forest.**
- **The Nature Conservancy, through funding provided by the USDA Joint Chiefs' -WVRV initiative, released 83 acres of understory red spruce in the Greenbrier River watershed within the Upper Greenbrier North project area. Additional acres of release are currently in progress.**

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

Accomplishments

- **USFS Greenbrier RD, in collaboration with Green Forests Work (GFW), implemented 101 acres of ecological restoration (site prep and native planting) in the Lambert Project Area on the Mower Tract. 72 lbs of native seed was sown with approximately 25,575 native seedlings planted. 2,715 of the plants were grown by the NRCS Appalachian Plant Material Center.**
- **TNC planted 5000 spruce at Craneville Swamp Preserve.**
- **USFWS- CVNWR planted 3300 red spruce over 32.3 acres along the Blackwater River (48 volunteers, 264 hours)**
- **USFWS-CVNWR planted 5000 red spruce over 50 acres on Cabin Mountain (56 volunteers, 198 hours)**
- **MNF planted 6,000 seedlings on decommissioned roads in the Upper Greenbrier North project area on the Greenbrier RD.**
- **WV Highlands Conservancy provided 500 seedlings, which were planted on private property adjacent to MNF.**
- **WV Highlands Conservancy provided Savage River Watershed Association with 200 seedlings.**
- **WV Highlands Conservancy provided Timberline Homeowner's Association with 500 seedlings, which were planted on private lands adjacent to CVNWR.**
- **WV Highlands Conservancy provided Allegheny National Forest with 2,000 seedlings.**
- **WV Highlands Conservancy provided Savage State Forest in western Maryland with 300 seedlings.**
- **WV Highlands Conservancy provided the Aurora Project with 200 seedlings, which were planted on private property in Preston Co., WV.**
- **The Nature Conservancy, through funding provided by the Wildlife Conservation Society's Climate Adaptation Fund, planted 35,000 red spruce tree seedlings and 14,000 northern hardwood tree seedlings across 186 acres of the Pharis Knob /Gandy Ranch conservation easement and seven acres of adjacent USFS land, for a total of 193 acres.**

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

Accomplishments

- **USFWS-CVNWR, USFS, NRCS- PMC, and AFHA AmeriCorps dug aspen root sections for propagation and eventual use in mine land restoration at Lambert North project site on the Greenbrier Ranger District of the MNF.**
- **USFS - Native seed collected and propagated in partnership with Alderson PMC: 1,226- Aspens, 858- Swamp Milkweed, 700- Silky Willow, 362- Summer Grapes, 96- Common Milkweed, 64- Butterfly Milk Weed, 24- Yellow Birch, 11- Flowering Raspberry, 9- Wild Raisins, 2- Steeplebush.**

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

Accomplishments

- **Kumbrabow State Forest established 4 permanent spruce research plots within the Morgan Camp project area and collected pre-harvest baseline data for each plot.**
- **USFWS- CVNWR established and monitored 72 plots within three red spruce planting sites - one from a 2009 red spruce planting and two from the 2014 plantings conducted at CVNWR.**

- **Monitoring subcommittee has developed and finalized spruce release monitoring datasheet rapid assessment of spruce release sites.**
- **Monitoring subcommittee has developed and finalized rapid assessment monitoring datasheet for spruce plantings**
- **Monitoring subcommittee has developed and finalized rapid assessment monitoring protocol for spruce plantings**
- **Monitoring subcommittee has developed and finalized Access database for entering spruce planting monitoring data**
- **The Nature Conservancy established 20 permanent monitoring plots within the Pharis Knob/Gandy Ranch project area.**
- **USFS – Continued to conduct monitoring at Lambert.** ***(Refer to II.A.3.)***

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.

Accomplishments

- **With funds provided by the Outdoor Heritage Conservation Fund, the Nature Conservancy purchased through fee acquisition a total of 72 acres on High Mountain, within the Mount Porte Crayon landscape**

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

Accomplishments

- **The Nature Conservancy worked with NRCS to approve an adjustment to tree planting standards that applies to red spruce being planted on forest and agricultural lands. The adjustment takes into consideration that spruce is more expensive and time consuming to plant.**

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.

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

- **Corinne Diggins (Virginia Tech) completed a 3rd field season. In 2014, Corinne conducted a microhabitat assessment for Virginia Northern Flying Squirrel using telemetry data collected from thirteen VNFS. Initial results indicate a preferential selection of foraging sites with deeper organic horizons and conifer dominant overstories.**
- **Mitzy Schaney from WVU's geology department is working with radio carbon dating and pollen records in the peatlands at Canaan. One hypothesis is that the peatlands may have been spruce forest at one point.**
- **Brandon Davis, a student working with Dr. Scott Mills at North Carolina State University, is tracking snowshoe hares on the Monongahela National Forest to study the relationship between color change and weather patterns.**
- **Melissa Thomas-Van Gundy used the landscape-scale model LANDIS-II to simulate red spruce (Picea rubens Sarg.)-dominated forest response to restoration actions for 100 years: Thomas-Van Gundy, M. A. and B. R. Sturtevant. 2014. Using scenario modeling for red spruce restoration planning in West Virginia. Journal of Forestry. 112: 457-466.**
- **Jim Rentch and others presented 6 year results of understory red spruce release experiment from 6 areas in east central WV: Rentch, J.S., W.M. Ford, T.S. Schuler, J. Palmer, and C.A. Diggins. In press. Release of suppressed red spruce using canopy gap creation - ecological restoration in the central Appalachians. Natural Areas Journal.**

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

Accomplishments

- **USFWS – CVNWR manually treated 1.4 acres of thick beech brush (a result of non-native beech bark disease) in red spruce habitat. Manual treatment was conducted, rather than chemical, because of known Cheat Mtn. Salamander occurrence.**
- **DNR, with support of the USFS Greenbrier Ranger District skid-mulched 5 acres on a strip mine and will continue.**
- **USFS Greenbrier RD in partnership with the EPA, CASRI, WVDNR, Appalachian Regional Reforestation Initiative (ARRI), Green Forest Works, NRCS, Plant Materials Program, and American Rivers conducted 150 acres of site preparation on coal mine benches (deep ripping, knocking down non-native conifer trees and organic loading) (Lambert South).**
- ***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.

Accomplishments

- ***See I.B.6 for further information on monitoring of restoration treatments.***
- **Plots were established at the Lambert project area on the Greenbrier RD of the Monongahela NF. Baseline data were collected to determine downed woody debris loading.**

Objective B. Reduce and prevent forest fragmentation.

Key Actions

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

Accomplishments

- **WVRV project "Mapping Forest Restoration Potential in the Red Spruce Ecosystem" involves data collection, mapping, Ecological Site Descriptions (ESDs), and soil carbon research in the high elevation red spruce habitat (>100,000 acres of federal, state and private lands). The information produced by this work is helping to focus spruce restoration efforts that are aimed at sequestering carbon, improving water quality, and restoring habitat for rare species such as the threatened Cheat Mountain salamander and the sensitive West Virginia northern flying squirrel**.

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

Accomplishments

- **The Nature Conservancy began a mapping project to identify and prioritize lands for red spruce conservation and restoration potential. A final map product should be completed in 2015.**
- **Victoria Woltz, an AmeriCorps member with TNC, is working on identifying specific high priority sites for conservation.**

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

Accomplishments

- **USFS, USFWS, WVDNR, TNC, and others engaged in ongoing discussions with project proponents and other stakeholders to limit the impacts of a proposed natural gas transmission pipeline.**
- **The Nature Conservancy completed a Critical Habitats Assessment that identifies areas with high biodiversity conservation value. This data set is being shared with project planners and reviewers to identify areas where a potential project overlaps with such resources so that impacts to critical habitats can be avoided, minimized, or mitigated.**

II.B.4. Increase road decommissioning projects.

Accomplishments

- **The Monongahela National Forest decommissioned 18.2 miles of roads in the Upper**

Greenbrier North project area on the Greenbrier RD: 7 miles in Mountain Lick Creek, 2.9 miles in Gum Cabin Hollow, 0.9 miles in Fivemile Hollow, 1.9 miles of Abe's Run, and 5.5 miles in Mullenax Run, accounting for 56 total acres.

- **NCRS is adopting "road abandonment" as a standard practice on private lands in West Virginia.**

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

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

Key Actions

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

Accomplishments

- ***See I.A.2, 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.

Accomplishments

- **Dr. Mark Anderson, Senior Conservation Scientist for The Nature Conservancy's Eastern Region, is working on scaling down resiliency analyses to examine and grade connectivity.**
- **The Nature Conservancy is testing a pilot project looking at landscape features that may facilitate permeability at the local and landscape scale across the Appalachians. A final connectivity assessment will be integrated into the Resilient Sites analysis and released in 2015.**

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

Accomplishments

- ***See I.B.2., II.B.1, and II.B.2 for more information.***

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

Accomplishments

- ***For more information, see I.C.1.***

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

Key Actions

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

Accomplishments

- **Joint Chiefs funding for the WVRV project allowed the MNF and TNC to continue operation of the Potomac Highlands CWPMA NNIS field crew, which is employed by TNC. The crew treated 755 acres of invasive species on the MNF, and additional acres on private land in the larger landscape. This operation will continue into FY 2015 and 2016.**
- **The WV DOF treated 19 acres of invasive species on state forest lands.**
- **The USFS-Greenbrier RD conducted 235 acres of NNIS treatment in various parts of the high elevation landscape.**
- **Kumbrabow State Forest treated 2 miles of road for Japanese stilt grass.**
- **As part of their larger treatment plan, the Potomac Highlands CWPMA field crew treated 576 acres of invasive species in and around spruce-northern hardwood forests.**
- **The Ecological Restoration Team treated 26 acres of invasive species in and around spruce-northern hardwood forests.**
- **USFWS – CVNWR manually treated 1.4 acres of beech brush in red spruce habitat. (*See II.A.2*)**

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

Accomplishments

- **Clean equipment was used in all projects involving CASRI partners.**

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

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

Accomplishments

- **With funding provided through the Joint Chiefs WVRV project, conservation partners in West Virginia began utilizing a GIS-based early detection and rapid response system called IMapInvasvies. This system will be fully operational in 2015 to provide users pertinent information on NNIS threats across the landscape.**
- **Don't Move Firewood campaign.**

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

Accomplishments

- **The treatment and kill rate at Lambert and Barton Bench (USFS-Greenbrier RD) were monitored.**
- **During spruce monitoring of restoration sites, CVNWR and USFS also made note of any invasive species present within plots. (*referred to in I.B.6.*)**
- **As part of the treatment mentioned in *II.D.1*, the PHCWPMA field crew monitored all sites for new infestations. These surveys extended beyond the treatment area and totaled 596 acres, adjusted for species treated.**

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

- **106 vernal pools/wetlands were created at Lambert North on the Greenbrier RD.**
- **129 vernal pools/wetlands were created at Lambert South on the Greenbrier RD.**
- **Kumbrabow State Forest created 25 vernal pools/wetland areas.**

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

Accomplishments

- **USFS ensured that buffers were in place for Upper Greenbrier release work.**
- **Kumbrabow State Forest ensured buffers were in place over 300 acres of commercial harvest area.**

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

Accomplishments

- **USFWS – CVNWR planted approximately 2 acres of unforested riparian areas with red spruce during fall planting event along the Blackwater River. (*See I.B.4.)***
- **The WV Highlands Conservancy has sold spruce seedlings to various groups for this purpose.**

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

- **The restoration treatments at Lambert (USFS-Greenbrier RD) increased infiltration and reduced surface runoff by deep-ripping compacted reclaimed mine lands.**
- **Intercepted ground water and overland flow were reduced by decommissioned roads. *For further information, see II.B.4.***

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

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

- **Stephanie Connolly (USFS-MNF) gave graduate level presentations on restoration and associated spodols. Soil morphology can provide insight into how ecosystems change following periods of extensive disturbance, and soils properties can often be linked to**

historic environmental influences (e.g., vegetation or climate) to provide a record of pedomemory. Identification and mapping of soil pedomemory properties show promise in providing context for ecological restoration, including that of the red spruce-northern hardwood ecosystem. The full paper by Travis Nauman et al. can be viewed here: http://www.sciencedirect.com/science/article/pii/S0016706115000427

- **NRCS and USFS-MNF updated land for soil survey and for Ecological Site Inventory; two new Red Spruce ESDs developed (*Refer to II.B.1.)***
- **NRCS and USFS-MNF collected data to support the soil survey update and ESD development.**

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-MNF conducted sampling of dissolved organic carbon in streams in conjunction with the USFS-Northern Research Station.**
- **Visibility assessments were done at Bearden Knob as part of the Forest Service's air quality monitoring program. Real time images of sites across the country can be viewed at the following link. (http://www.fsvisimages.com/descriptions.aspx)**

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

Accomplishments

- ***Refer to II.B.1.***

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

Accomplishments

- **NRCS conducted Soil Survey Update and Ecological Resource Inventory in Red Spruce Ecosystem: Reclassified Mandy soil series is now on Web Soil Survey.**
- **WVU and NRCS collected 700+ O-horizon soil samples from Cheat Mountain salamander sites.**

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

- **Spruce release and planting efforts were focused on high priority sites for enhancing landscape-level connectivity.** ***Refer to I.B.3. and I.B.4.***

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

Accomplishments

- **Spruce release and planting efforts were focused on high priority sites for long-term resilience to the impacts of climate change.** ***Refer toI.B.3. and I.B.4.***

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.** ***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.

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

Accomplishments

- **USFWS and CVNWR conducted annual Cheat Mtn. Salamander surveys.**

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.

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

Accomplishments

- ***See II.A.1and II.F.4 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.

Key Actions

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

Accomplishments

- **Appalachian Voices published an article "Rescuing the Red Spruce Ecosystem" about CASRI.**
- **TNC magazine published an article "Flying High" about flying squirrel monitoring in the MNF.**
- **Kiosk created for Lambert North to be installed in 2015.**
- **The CASRI facebook page is updated regularly and currently has 396 likes.**
- **The Nature Conservancy completed a 4-minute video on landscape resilience.**

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

Accomplishments

- **The CASRI website was maintained and kept updated.**

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

Accomplishments

- **Kristin Stockton, an AmeriCorps member with USFS, created a red spruce ecosystem educational trunk and will be taking it to local schools and festivals. The trunk is available for use through the Monongahela National Forest Supervisor's Office.**
- **USFWS – CVNWR engaged in audiovisual outreach "Conservation Connect" to highlight refuge biologist activities. This was conducted as part of a new web-based video series produced by the U.S. FWS National Conservation Training Center, which aims to connect youth, ages 9-13 with the great outdoors, wildlife species, and conservation careers. Special emphasis for this video was placed on the Cheat Mountain Salamander and the red spruce ecosystem. The video will be available for viewing in the future.**

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

- **Kumbrabow State Forest hosted the CASRI Active Spruce Restoration field tour.**
- **Andrea Brandon of the Nature Conservancy presented to the Southern Appalachian Red Spruce Restoration Initiative Annual Meeting (2014). The topic of the presentation was "CASRI Lessons Learned."**
- **Andrea Brandon of The Nature Conservancy presented to the Southern Highlands Reserve's "Conservation Through Restoration" Symposium (September 2014) about "Red Spruce Restoration in the Appalachians" with a focus on the importance of red spruce, the need for restoration, working collaboratively, and defining a vision for the future of spruce efforts across the Central and Southern Appalachians.**
- ***See II.F.1***

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

- **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, created in 2013, is growing in capacity.**

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

Accomplishments

- ***See I.C.I.***

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

Accomplishments
• **The USFS-MNF and The Nature Conservancy continue to provide financial support for the Monongahela National Forest partnership coordinator position. This position coordinates CASRI and other restoration efforts in the central Appalachians. The USFS-MNF provided additional support for a 2014-2015 AmeriCorps member to further expand CASRI's capacity.**

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.