
CASRI
The Central Appalachian
Spruce Restoration Initiative

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2011 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 Central Appalachia. 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), Canaan Valley National Wildlife Refuge (CVNWR), Natural Resources Conservation Service (NRCS), The Mountain Institute (TMI), The Nature Conservancy (TNC), Trout Unlimited (TU), U.S. Forest Service Northern Research Station (NRS), U.S. Fish and Wildlife Service (USFWS), 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.

The CASRI partnership began as a small working group that was formed to conserve the endangered 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, 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 the red spruce ecosystem and the diversity of plants and wildlife it supports. CASRI partners developed this mission statement to sum up the purpose of the group:

> *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, the CASRI partners developed a strategic action plan to guide restoration efforts over the next decade (CASRI Action Plan). This action 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 partners developed a technical document that outlines restoration objectives and methods in various spruce-northern hardwood habitats (Restoration Approach).

CASRI partners would like to thank all of the hardworking volunteers that support our projects. This restoration effort would not exist without the countless hours volunteers dedicate! CASRI would also like to thank all of the generous organizations that have contributed funding to support on-the-ground efforts.

2011 proved to be another successful year for the growing restoration initiative. CASRI partners helped raise an additional $16,547.00 for on-the-ground projects in 2011, adding to the $145,794.00 raised since 2006. CASRI partners planted 56,100 seedlings, received $36,230.00 in in-kind services, and recruited over 2,175 volunteer hours. Acres planted totaled 165 acres for 2011, adding to the over 550 acres planted since 2006. Over 160 acres of red spruce were released from the understory by commercial and non-commercial cuttings. Over 1,400 acres of potential spruce habitat were protected through land protection projects and conservation easements.

This report summarizes the restoration activities in which CASRI partners have engaged since the inception of the partnership six years ago. The activities are cross-referenced to the applicable goals, objectives, and key actions from the action plan. Only one year into the decade covered by the action plan, CASRI has made substantial progress toward achievement of several goals and objectives. However, much more work remains to make the CASRI vision a reality.

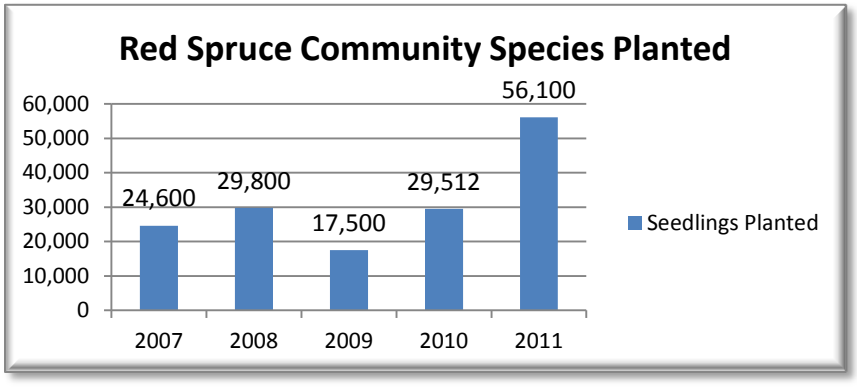
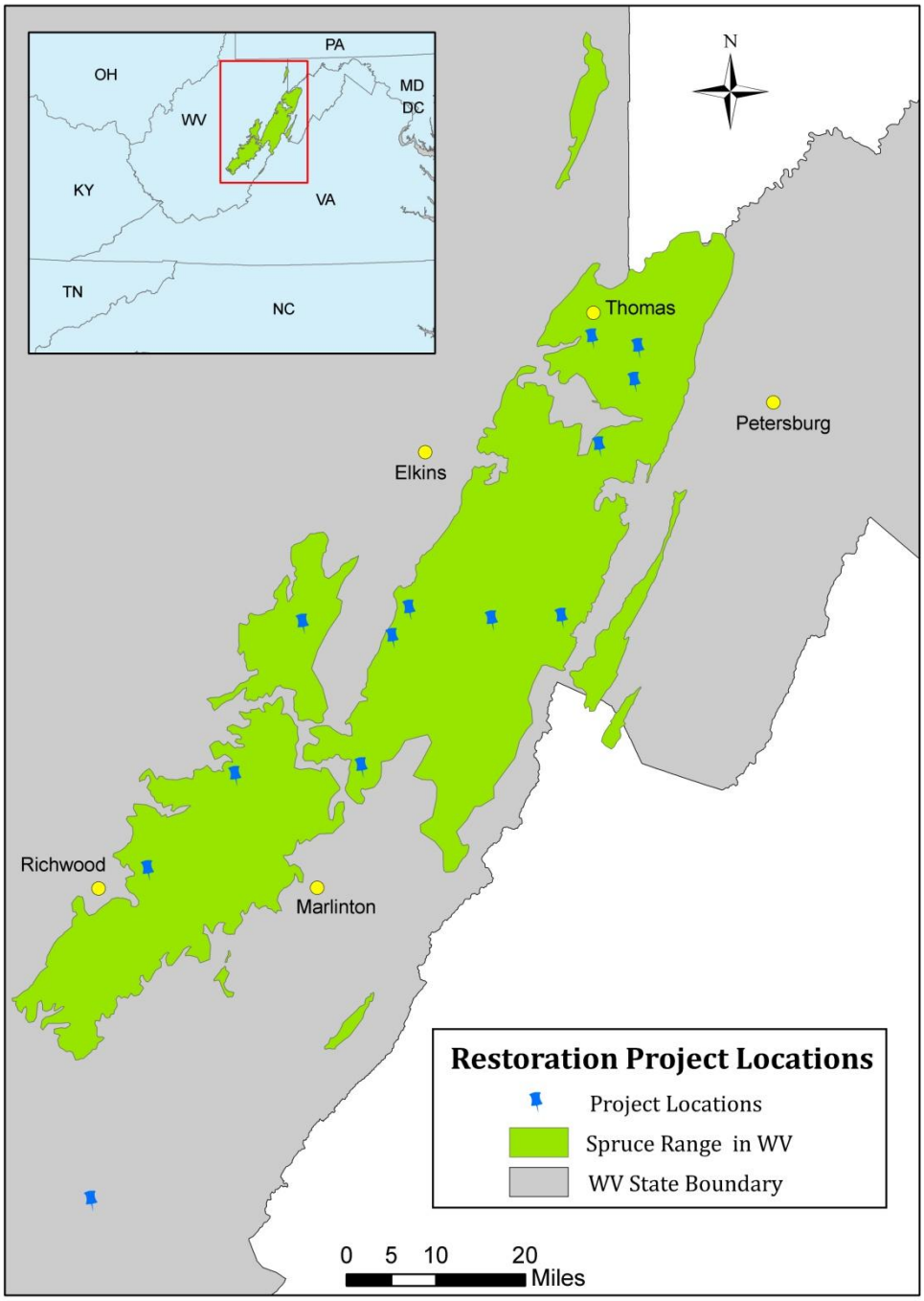


Table 1: Trees, shrubs, and herbs planted through CASRI efforts since 2007

PROJECT LOCATION MAP



2011 Highlighted Projects

Seed Collection Efforts

Figure 1: Spruce trees loaded with cones on Cheat Mountain, WV.

Red spruce and balsam fir trees throughout Central West Virginia produced a massive crop of cones in 2011. Many CASRI partners including the West Virginia Highlands Conservancy, U.S. Forest Service, and Canaan Valley National Wildlife Refuge took this great opportunity to collect bushels of cones. The cones are now being dried for seed extraction at the NRCS Alderson Plant Materials Center and a local seed processor. The seed will be stored to ensure the supply of spruce and fir seedlings in the future. Cones collected were carefully labeled and separated according to their location. The U.S. Forest Service, West Virginia Highlands Conservancy, and NRCS also collected seeds from several other species in the spruce-northern hardwood ecosystem, including mountain ash, mountain holly, cucumber magnolia, manna grass and many others.

Barton Bench Ecological Restoration

Barton Bench is a 100-acre project area on the Greenbrier Ranger District of the Monongahela National Forest. The tract was strip-mined for coal in the 1970s. The federal reclamation standards in place at the time succeeded in stabilizing the site, but they left the area in a less-than-desirable condition from an ecosystem restoration standpoint. The soils in the project area were degraded and heavily compacted. The area was planted with predominantly non-native grass species, resulting in a dense grass mat that inhibited native species recolonization. This state of 'arrested succession' was unlikely to correct itself without intervention. The objective of the Barton Bench ecological restoration project is to establish and restore native species of shrubs, trees, and herbaceous plants to this area. The short term goal (5-20 years) of the project is to enhance habitat for early successional species; the long-term goal is to restore the native red spruce ecosystem.

Figure 2: Dozer "deep ripping" at Barton Bench to prepare ground for planting red spruce.

In 2010 the site was prepared for planting using a technique known as "deep ripping." Deep ripping involved using a bulldozer to

pull a three-foot-long ripping shank through the soil in a criss-cross pattern. This technique broke up the compaction and sod grasses that had been impeding tree and shrub colonization for decades. In 2011 the site was further enhanced by the construction of over 130 vernal pool wetlands and two stream segments, which were built to slow the uncontrolled runoff of groundwater that was intercepted and brought to the surface in the mined areas. The restoration effort was capped by the planting of over 27,000 native plants, including a large component of red spruce. A brochure was printed and a three-panel interpretive kiosk was installed to inform the visiting public of the history of the area and the importance of restoring the red spruce ecosystem.

Although the U.S. Forest Service led the Barton Bench restoration effort, the tremendous amount of work accomplished through this project would not have been possible without the contributions of numerous partners. Partners who helped fund, plan, or implement the work include AmeriCorps Appalachian Forest Heritage Area, AmeriCorps NCCC, Appalachian Coal Country Watershed Team, Appalachian Regional Reforestation Initiative, Arbor Day Foundation, Natural Resource Conservation Service's Appalachian Plant Materials Center, Potomac Highlands Cooperative Weed and Pest Management Area, The Center for Wetlands and Stream Restoration, The Nature Conservancy, United States Fish and Wildlife Service, West Virginia Department of Environmental Protection, WesMonTy Resource Conservation and Development Council (RC&D), West Virginia Division of Forestry, West Virginia Division of Natural Resources, West Virginia Highlands Conservancy, U.S. Office of Surface Mining Reclamation and Enforcement, Brooks Bird Club, Highland Adventist School, Izaak Walton League, National Wild Turkey Federation, Ruffed Grouse Society, Northern West Virginia Brownfields Assistance Center, and Tygarts Valley Conservation District.

Results from the 100 acre Barton Bench project will be used to implement similar mine restoration projects on approximately 2,000 acres.

PROTECTION OF KEY PARCELS

The 2000 acre tract of land known as the Thunderstruck Tract along Spruce Run in Randolph County is one of the most ecologically important tracts within the CASRI focal areas. The tract's higher elevations have an important red spruce community that is home to the federally threatened Cheat Mountain Salamander, and provide habitat for the federally endangered WV northern flying squirrel. The forests buffer the famous Mount Porte Crayon and tie in to over 100,000 acres of forest that comprise the remote and intact Roaring Plains and the Dolly Sods areas. The position of the tract and its highly varying topography and elevation also make it an essential acquisition to help secure a connector that will allow for adaptation and species flow across the greater landscape as climate change plays out. Additionally, the tract is home to caves and karst features which support numerous rare species.

Since 2007 The Nature Conservancy, the U.S. Forest Service, West Virginia Division of Natural Resources and the U.S. Fish and Wildlife Service have been working with the property owners to protect this important tract. In 2008 an easement was placed on the lower elevations to protect important cave and karst features. Most recently, in 2011, the US Forest Service and the Nature Conservancy purchased an additional 1,100 acres surrounding the easement, securing the lands as part of the Monongahela National Forest. Continuing negotiations with the landowner have led to the remaining 600 acres of the tract being placed under contract for sale to The Nature Conservancy. In March the Conservancy plans to transfer 300 of these acres to the US Forest Service.

The Thunderstruck Tract helps connect over 100,000 acres of forest that comprise Roaring Plains and the Dolly Sods areas, providing important buffer to these remote and intact forested areas.

Protecting the entire 2000 acres was an extraordinary case study in how partners can come together to protect high priority areas, negotiate, and fund complicated land deals.

CITIZEN'S SCIENCE SPRUCE MAPPING

Mapping the extent of existing red spruce communities is important for informing CASRI partners so they can better allocate resources and implement landscape scale restoration. The West Virginia Division of Natural Resources and Monongahela National Forest teamed up to complete aerial photo interpretation of conifer cover for much of West Virginia. The map currently has over 13,000 polygons showing high, medium, low, or absent conifer cover. However, distinguishing between red spruce and other conifer species is difficult using aerial photography alone. In order to "ground-truth" this conifer map, CASRI partners launched a citizen's science based mapping effort in 2011.

The mapping protocol is designed to be simple and effective. Volunteers and CASRI partners can quickly collect GPS points while recreating or working in the field. Each point is assigned a primary and secondary code to indicate the percent spruce cover (high, medium, low, or absent) and the type of cover (canopy or understory). These points can be easily downloaded with free DNR Garmin software and transferred into an excel spreadsheet. Once the spreadsheet is emailed to the CASRI coordinator, it is projected on a website hosted by the West Virginia DNR. Volunteers are able to track their progress and identify areas still in need of ground-truthing.

In 2011 CASRI partners collected a few thousand points. In addition to these points, several volunteer training sessions were held in an effort to mobilize a volunteer base. It is estimated that roughly 10,000 points will be needed to accurately determine the location and condition of spruce on the ground. The effort will be helped in 2012 with additional support from a U.S. Fish & Wildlife Service AmeriCorps member.

CASRI ACCOMPLISHMENTS, 2006-2011

The projects highlighted above show some of CASRI's biggest accomplishments for 2011, but those projects comprise only a part of the systematic, landscape-scale restoration effort that CASRI

partners have been pursuing over the last six years. The following presents a cumulative summary of accomplishments related to key actions, objectives, and goals outlined in the 10 year CASRI Action Plan. 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 I. *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.

Accomplishments

- **TNC provided input to the George Washington National Forest Plan Revision for red spruce habitat restoration. Comments were incorporated into the plan.**
- **CVNWR completed a Comprehensive Conservation Plan for the refuge. The plan establishes goals and objectives for red spruce protection and restoration on the refuge for the next 15 years and specifically states the refuge will work towards encouraging landscape-level, multi-partner efforts.**
- **In 2006 The Monongahela National Forest adopted Forest Plan direction that emphasizes passive management in mature stands that already have an adequate spruce component.**

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

Accomplishments

- **The CASRI/USFS-MOF Partnership Liaison cultivated relationships with two private timber company landowners who are interested in restoring red spruce on their properties.**
- **CVNWR, USFS-MOF, & WVHC helped Timberline Homeowners Association develop potential restoration map and applied for a grant to plant spruce on conservancy property.**
- **Plum Creek Planted red spruce on 20 acres of their land in Randolph County, WV.**
- **USFWS Partners worked towards an agreement with Snowshoe to develop spruce restoration and interpretive sites.**

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

- **The CVNWR started mapping priority areas for spruce planting as a part of the Habitat Management Plan. These areas include T&E habitat, riparian corridors, and connecting existing patches.**
- **Maximum Entropy modeling conducted by the WVDNR Heritage Program has the potential for identifying suitable restoration sites, in addition to producing a map of existing spruce ecosystems.**

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

Accomplishments

- **CASRI partners outlined reference conditions in the "Restoration Approach" document.**

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

- **Greenbrier Ranger District (USFS-MOF) conducted spruce release on Cheat Mountain (156 acres in 2011 and 74 acres in 2010).** ***See also Goal II, Objective A, Key Action 2.***
- **Kumbrabow State Forest (WVDOF) conducted timber sales resulting in 10 acres of spruce release.** ***See also Goal II, Objective A, Key Action 2.***
- **Greenbrier Ranger District (USFS-MOF) released a draft Environmental Assessment for a vegetation management project that would include over 1,400 acres of non-commercial spruce release and over 1,100 acres of commercial spruce release.**
- **Gauley Ranger District (USFS-MOF) conducted 80 acres of snag creation in young spruce stands in 2009.**

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

Accomplishments

- **TNC planted 10 acres of red spruce on private property in Canaan Valley.**
- **USFS planted 100 acres of mixed spruce/n. hardwood and shrub species at Barton Bench.**
- **CVNWR planted 37 acres of red spruce and 3 acres of balsam fir.**
- **Canaan and Blackwater State Parks landscape contracting firm requested assistance from WVDNR Heritage for recommended native species.**
- **CVNWR planted 15 acres of speckled alder.**
- **The Mountain Institute planted 20 acres of mixed spruce/n. hardwood with the help of WV students at TMI's Spruce Knob Mountain Center property.**

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

Accomplishments

- **CVNWR issued a special use permit to WVHC to collect native plant seeds.**
- **CVNWR collected 3 gallons of speckled alder cones to be grown at the State Nursery.**
- **USFS-MOF issued a permit to WVHC to collect red spruce cones on the Monongahela National Forest.**
- **TNC, USFS-MOF, and WVHC collected balsam fir cones at Blister Swamp and Blister Run.**
- **USFS-MOF (Greenbrier District) and NRCS (Alderson Plant Materials Center) collected native seed including holly, mountain ash, cucumber tree, mannagrass, aspen, and spruce for use in ecosystem restoration projects.**
- **TMI collected 56 gallons of red spruce seed cones on Spruce Knob Mountain Center property with the help of WV public school students.**
- **WVHC collected a variety of native shrub species seed.**
- **Tucker Co. High School received a USFS-MOF grant to build a greenhouse for native plant propagation and to develop educational curriculum on native plants.**

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

Accomplishments

- **CVNWR, USFS-MOF, and WV State Parks monitored approximately 40 acres of restoration plantings using the CASRI "Rapid Assessment" monitoring plan.**

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

- **CVNWR recently acquired a 325-acre parcel containing about 55 acres that will be actively managed for red spruce/conifer restoration. The restoration work will protect a riparian corridor and increase habitat connectivity.**
- **CVNWR purchased another 35 acres in 2010 near Bearden Knob on Canaan Mtn. that is suitable for red spruce restoration.**
- **USFS-MOF and TNC completed acquisition of another 1,083-acre portion for the Thunderstruck property. This tract is a good northern hardwood buffer forest and a habitat connector to Roaring Plains Wilderness.**

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

Accomplishments

- **TNC and partners submitted a grant application to secure an easement on Pharis Knob, which would connect two critical areas of flying squirrel habitat.**

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.

Accomplishments

- **USFWS Partners Program assisted landowner in Mingo with completing a WHIP application for red spruce restoration on 10-20 acres.**
- **Private landowner in Gandy area continued planting spruce on his property with support from WHIP.**

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

- **WVDNR and the USFS-MOF created a protocol for validating the USFS contract mapping of spruce ecosystems and the WVDNR maximum entropy modeling of spruce ecosystems.**
- **TMI began ground truthing the spruce mapping efforts as part of their educational curriculum.**

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.

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

Accomplishments

- **Greenbrier Ranger District (USFS-MOF) planted nearly 100 acres of mixed spruce-n. hardwood and shrub species at Barton Bench. 130 vernal wetlands containing coarse**

woody debris were also created.

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

Objective B. Reduce and prevent forest fragmentation.

Key Actions

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

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.

II.B.4. Increase road decommissioning projects.

Accomplishments

- **Greenbrier Ranger District (USFS-MOF) released a draft Environmental Assessment for a vegetation management project that would decommission 118 miles of roads, many of which lie within spruce and northern hardwood habitat.**
- **USFS-MOF planted 5,000 red spruce seedlings on decommissioned roads.**

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.

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

Accomplishments

- **The Greenbrier Ranger District (USFS-MOF) released a draft Environmental Assessment for a vegetation management project that would increase connectivity of spruce forest fragments across the upper portion of the Greenbrier River watershed.**

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

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

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

- **The USFS-MOF treated two garlic mustard infestations totaling 5 acres in northern hardwood and spruce habitat on the Greenbrier District.**
- **TNC, the Potomac Highlands Cooperative Weed and Pest Management Area, and the USFS collaborated on treating a 1.7 acre yellow iris infestation in Blister Swamp (Greenbrier District).**
- **The WVDOF and the USFS-MOF collaborated on treating 0.7 acres of reed canary grass and 0.12 acres of crown vetch at the parking area for the Cranberry Glades Botanical Area/National Natural Landmark (Gauley District).**

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

Accomplishments

- **The USFS-MOF (Greenbrier District) applied clean equipment and weed-free mulch standards to all of the earth-disturbing activities associated with the Barton Bench project.**

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

Accomplishments

- **The NRCS (Alderson Plant Materials Center) continued to work with the USFS-MOF, USFWS-CVNWR and other partners to provide native plant material for ecosystem restoration efforts.**
- **The WVDNR, USFS-MOF, NRCS and others developed a list of potential native plant species for use in high-elevation restoration sites.**

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

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

Accomplishments

- **Plots at Idleman's Run on CVNWR and Blackwater Falls State Park were monitored for invasive species.**

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

- **130 new wetland/vernal pools created at Barton Bench. Approximately 10,000 native plants were planted in and around these wetlands.**

- **TNC protected existing balsam fir populations in Canaan Valley on private property by building 15 new cages around natural regeneration.**

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

- **The USFS-MOF (Greenbrier District) released a draft Environmental Assessment for a vegetation management project that would include riparian planting along 36 miles of streams, many of which flow through spruce and northern hardwood ecosystems.**
- **USFS-MOF (Greenbrier District) planted 7.05 miles of decommissioned roads and approximately 1.5 miles of riparian areas in the Upper Greenbrier.**
- **USFS-MOF (Greenbrier District) released an Environmental Assessment for Lambert Run, which is the next restoration phase for the Mower Tract.**
- **TNC planted 10 acres of red spruce to buffer the north branch of the Blackwater River on private property in Canaan Valley.**

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

- **Greenbrier Ranger District (USFS-MOF) completed deep ripping on nearly 100 acres at Barton Bench as part of the first phase of the Mower Tract restoration.**

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

- **USFS-MOF signed the Decision for the Lower Williams Terrestrial Liming Environmental Assessment.**
- **USFS-MOF conducted a soil chemistry survey in the Big Mountain area (Potomac Ranger District) to determine if acid deposition and soil quality effects would be a concern. Some of these areas would support red spruce.**
- **USFS-MOF added two additional full soil characterization pits in spodosol like soil profiles under red spruce.**
- **USFS-MOF hosted a WV Cooperative Soil Survey field week in the Upper Greenbrier watershed to collect data in red spruce ecosystems.**

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

Accomplishments

- **USFS-MOF Soil Scientist and Dr. Jim Thompson presented at the National Cooperative Soil Survey meeting to ask for assistance from NRCS to conduct a risk assessment of watersheds what would act as potential bioavailable mercury sources.**
- **CVNWR cooperated with USFWS contaminants biologists and Canaan Valley Institute to measure mercury accumulation in vernal pool amphibian eggs. Very low levels were found in these subjects.**

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

Accomplishments

- **USFS-MOF, WVU, and NRCS worked to document soil carbon stocks on the Forest to develop the USFS Climate Framework strategy.**
- **USFS-MOF, WVDNR, NRCS and WVDEP sampled wetland sites for carbon. This data will be uploaded into NRCS NASIS databases and utilized in refining carbon data for the soil survey.**
- **USFS-MOF had marginal success in recording soil moisture and temperature in folistic epipedons in the Upper Greenbrier. The project design and equipment is being re-evaluated.**

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

Accomplishments

- **NRCS, USFS-MOF, and WVDNR Heritage Program started development of the red spruce ecosystem ecological site descriptions.**

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.

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

- **USFS-MOF planning for the Upper Greenbrier North project (Greenbrier District) used the optimal habitat preferences of the WV northern flying squirrel (>30% spruce in the overstory) as a general target for red spruce restoration.**

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

- **CVNWR currently conducts recovery actions (monitoring) for both WV northern flying squirrel and Cheat Mountain salamander.**
- **The USFS-MOF conducts forest-wide inventory and monitoring for the WV northern flying squirrel, Cheat Mountain salamander, and northern goshawk.**

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

Accomplishments

- **USFS-MOF and TNC completed acquisition of another portion of the Thunderstruck property.**
- **TNC submitted an American Rivers proposal to protect and restore key WVNFS habitat in Gandy Creek.**

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.

Accomplishments

- **USFS-MOF (Greenbrier District) identified acres of WV northern flying squirrel habitat in the Upper Greenbrier North project area.**

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

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

Accomplishments

- **CVNWR summarized 10 yrs of CMS research on the refuge to look at trends in populations and the effectiveness of different survey methods.**

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

- **Interpretive kiosk was installed at Barton Bench as part of the WesMonTy Brownfields grant.**
- **An additional brochure highlighting CASRI was created and printed.**

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

Accomplishments

- **WVHC launched www.restoreredspruce.org to support CASRI efforts.**

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

Accomplishments

- **TNC purchased an additional 9 dibble bars for volunteer plantings.**
- **USFS-MOF, AmeriCorps NCCC and ARRI coordinated a volunteer tree planting event with Arbor Day Foundation and *Let's Move Outside* as part of the Barton Bench planting effort.**
- **CVNWR and the WVHC organized a volunteer planting event with Whitegrass, Adventure WVU and Davis & Elkins College.**
- **CASRI Coordinator delivered CASRI presentation to The Mountain Institute and teachers.**
- **CASRI Coordinator delivered CASRI presentation to OSM at the OSM annual staff retreat.**
- **WVDNR staff presented natural communities in the Central Appalachian red spruce ecosystem at NatureServe's "Biodiversity Without Boundaries" national conference in April 2011.**
- **TNC staff presented on CASRI at the annual SAF conference.**
- **TMI coordinated volunteer tree planting/education activities with 510 participants from WV public schools and various private schools from the mid-Atlantic region.**

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

Accomplishments

- **USFWS delivered information about Partners and Farm Bill programs to local timber company and Snowshoe.**

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.

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.

Accomplishments

- **CASRI held multiple conference calls with partners in North Carolina, Virginia, and Tennessee to provide support for spruce restoration across the 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

- **Multiple representatives from CASRI including multi-state partners attended LCC workshop in Blacksburg, VA.**

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

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

Accomplishments

- **USFS-MOF, TNC, and USFWS Partners Program and CVNWR supported a full-time position for the CASRI coordinator/Monongahela NF partnership liaison.**

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.

Accomplishments

- **USFS-MOF, CVNWR, TNC, WVDNR and TMI allocated personnel time toward monitoring CASRI restoration plantings.**

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