Cherokee National Forest Landscape Restoration Initiative Steering Committee Recommendations to the Forest Service for the North Zone (Watauga and Unaka Districts) of the Cherokee National Forest

February 10, 2012

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"Restoration, for me, means managing forest lands first and foremost to protect our water resources while making our forests far more resilient to climate change. In many of our forests, restoration will also include efforts to improve or decommission roads, to replace and improve culverts, and to rehabilitate streams and wetlands. Restoration will also mean the rehabilitation of declining ecosystems."

Tom Vilsack
Secretary, U.S. Department of Agriculture
August 14, 2009

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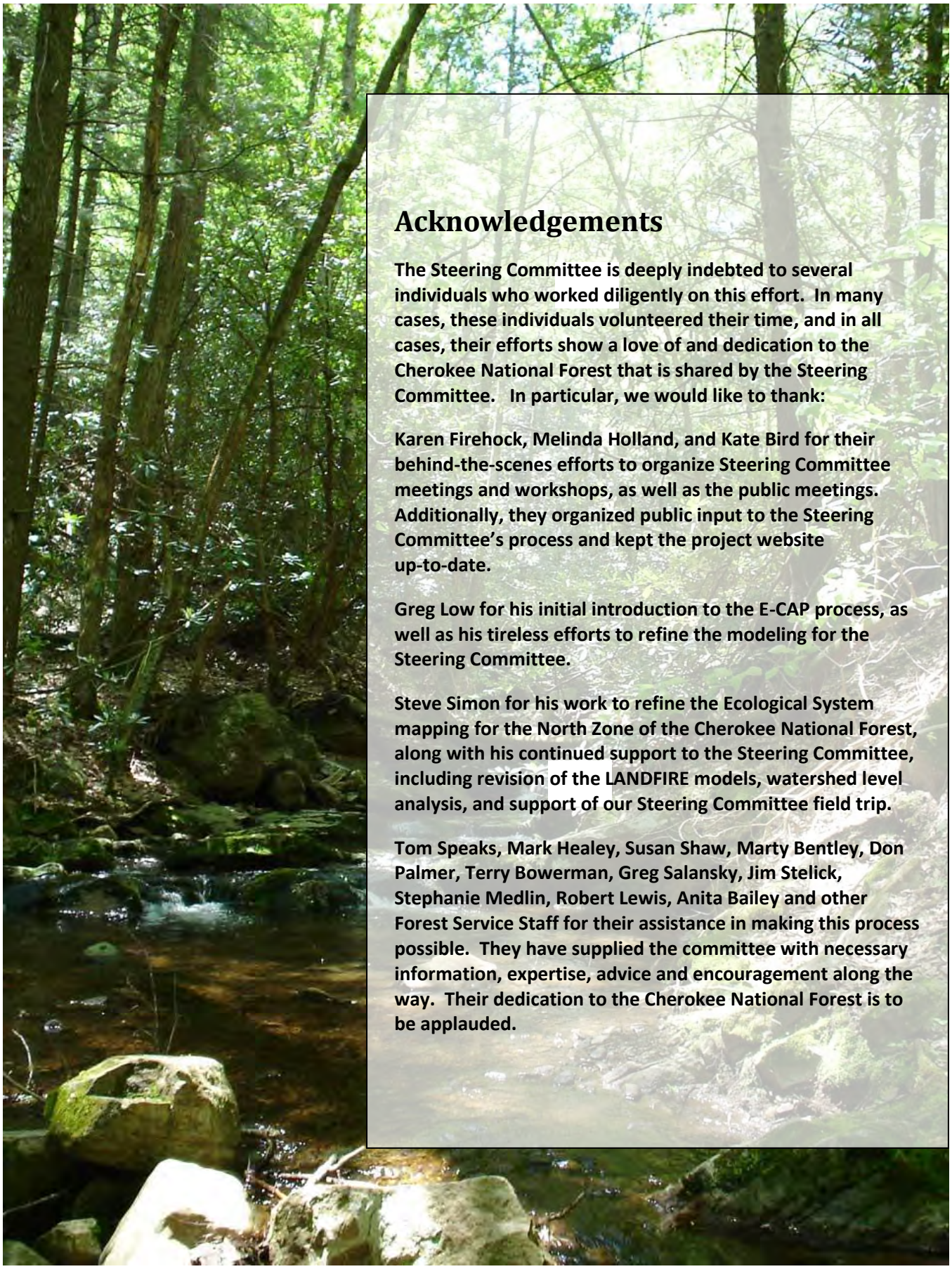

Acknowledgements

The Steering Committee is deeply indebted to several individuals who worked diligently on this effort. In many cases, these individuals volunteered their time, and in all cases, their efforts show a love of and dedication to the Cherokee National Forest that is shared by the Steering Committee. In particular, we would like to thank:

Karen Firehock, Melinda Holland, and Kate Bird for their behind-the-scenes efforts to organize Steering Committee meetings and workshops, as well as the public meetings. Additionally, they organized public input to the Steering Committee's process and kept the project website up-to-date.

Greg Low for his initial introduction to the E-CAP process, as well as his tireless efforts to refine the modeling for the Steering Committee.

Steve Simon for his work to refine the Ecological System mapping for the North Zone of the Cherokee National Forest, along with his continued support to the Steering Committee, including revision of the LANDFIRE models, watershed level analysis, and support of our Steering Committee field trip.

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INTRODUCTION

Background

The North Zone of the Cherokee National Forest (CNF) comprises some 340,000 acres and is located along the North Carolina border with Tennessee in the Blue Ridge physiographic province. The North Zone runs from Virginia to the Great Smoky Mountains National Park and is divided into two ranger districts—Watauga to the North and Unaka to the South. The CNF includes land in Carter, Cocke, Greene, Johnson, Sullivan, Unicoi and Washington Counties.

The CNF provides habitat for a high diversity of plant and animal communities linked to broad gradients of topography, elevation, and rainfall. The CNF provides key nesting, denning and feeding habitat for about 400 species of terrestrial vertebrates and 150 species of fish. Additionally, the Blue Ridge province is home to over 2,300 species of vascular plants and a diverse representation of non-vascular flora. The CNF is designated as the largest wildlife management area in Tennessee. (Source: CNF Land and Resource Management Plan, Jan. 2004)

The management of the Cherokee National Forest is currently governed by the Revised Land and Resource Management Plan (RLRMP), which was completed in January 2004. While this is an extensive document that represents a large amount of work on the part of the Forest Service staff and partners who developed it, it is not without controversy. The RLRMP took over seven years to produce and many partners were ultimately disappointed with the results. Additionally, after the five-year monitoring plan was completed, the Forest Service found that it was not meeting its implementation goals in many areas. One clear directive in the RLRMP was that the CNF was in need of restoration. However, the definitions of restoration or the way that it should be carried out on the ground were left unclear to many. Consequently, restoration at a landscape scale has been elusive for the CNF.

In an effort to obtain restoration at a landscape scale in the CNF, The Nature Conservancy, in partnership with the Forest Service, convened a diverse group of stakeholders with the purpose of developing a set of collaborative and ecologically sound restoration recommendations to the Forest Service. This document represents the efforts of that group, including the details of the process they undertook, as well as their final recommendations and plans for future engagement.

Case Statement

Purpose and Intent

The Cherokee National Forest (CNF) is home to an incredible array of natural, recreational, cultural and historic resources. Our purpose was to ensure that the Cherokee Landscape Restoration Initiative focused on the long-term, science-based ecological restoration and management of the native vegetation, rare communities, watersheds and aquatic systems to maintain and improve the overall health of the CNF. The history of the land shows us a landscape that has been altered by past land management practices. Some of these past influences have left portions of the CNF in a degraded and

unnatural condition. The introduction and imminent threat of numerous pests and pathogens further threaten the health of our forests and streams. Add to this the potential impacts from climate change, and it becomes obvious that the CNF would benefit from implementation of long-term restoration and management, in order to maintain and restore native vegetation, rare communities, watersheds, aquatic systems and healthy, resilient, robust forests.

The mission of the Forest Service is to sustain the health, diversity, and productivity of the nation's forests and grasslands, in order to meet the needs of present and future generations. The CNF has the responsibility to manage, protect and enhance the health of the vegetation and aquatic resources on federal lands in East Tennessee. Our intention was to support the CNF in achieving its mission through the implementation of a public participation process that was scientifically sound and ecologically appropriate. The process sought to find common ground among a diversity of interest groups to help the Forest Service make better decisions about the future of our shared natural resources.

Ecological restoration, as defined by the Society for Ecological Restoration, is "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." Sound forest restoration requires an integrated, multi-disciplinary approach rooted in conservation biology and ecosystem restoration principles that include preserving and protecting intact landscapes (particularly those that serve as reference or baseline conditions); allowing the land to heal itself; and, where necessary, helping it to do so through active restoration management. On Forest Service lands, "Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions. " (FSM 2020). Restoration should be scientifically supported and ecologically appropriate for the specific communities on the CNF. Actions would result in a healthy, resilient landscape, which "will have greater capacity to survive natural disturbances and large scale threats to sustainability, especially under changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses". (http://www.fs.fed.us/restoration/)

Approach and Objectives

A collective group of stakeholders came together to reach agreement on a science-based process for supporting the ecological restoration and adaptive management of the native vegetation, rare communities, watersheds and aquatic systems of the CNF. We worked collaboratively with the Forest Service to identify and prioritize the needs for restoration, and designed and completed a robust public participation component to this process that utilized a variety of sources, including national, regional and local/community expertise. Results were compiled and presented as a set of recommendations to the CNF, which can be considered for future management decisions.

Our approach emphasized public participation and information sharing in order to reach community-supported and science-based methods for forest management and to implement ecological restoration on the ground. The CNF has pre-defined procedures for determining management decisions. These procedures remain in place and have final authority over all action taken or not taken within the CNF. Recognizing this fact, it is imperative that those management recommendations that have emerged from the Landscape Restoration Initiative conform to these procedures.

The objectives for the Restoration Initiative were to:

- Define a common vision for the ecological restoration and management of the CNF.
- Engage/re-engage a diverse group of stakeholders interested in ecological restoration and

management of the CNF, including stakeholders from the local communities and other individuals or groups who were interested in participating in the process.

- Provide a structured process designed to engage a diverse group of stakeholders.
- Recommend a plan for the implementation of ecological restoration that includes specific measurable objectives and management actions that are consistent with the mission of the Forest Service.
- Establish a system for monitoring and evaluating restoration activities to allow for adaptive management over time.

Public Participation

A key goal for the CNF Landscape Restoration Initiative (CNFLRI) Steering Committee was to, "*Define a common vision for the ecological restoration and management of the CNF."* Engaging the public was a key mechanism for achieving this common vision. The committee stated that it wished to, "*Engage/re-engage a diverse group of stakeholders interested in ecological restoration and management of the CNF, including stakeholders from the local communities and other individuals or groups who are interested in participating in the process."* The Steering Committee requested that the US Forest Service retain a facilitation team who were qualified in environmental dispute resolutions and were listed on the National Roster of Environmental Dispute Resolution Professionals to assist in facilitation of the committee and with public engagement. Karen Firehock and Melinda Holland were hired in May 2010 to fulfill this role.

A project website was developed to inform the public throughout the process. The website included: a case statement that presented the basis for the committee's formation and associated goals, which can be found in the previous section; a meeting schedule and past meeting summaries and presentations; a background section for related documents, such as the current RLRMP; and the committee's work plan. The committee's decision protocols also were posted to the project website to ensure that the process was as transparent as possible. A factsheet about the project's process, as well as a Frequently Asked Questions document, were created to address the history of the project and common questions.

The public was engaged directly through stakeholder interviews, an on-line questionnaire and a series of public meetings. The public was also provided time at the beginning of each Steering Committee meeting to offer any comments, as well as to ask questions during the meetings. However, participation was not limited to committee or public meetings. The public also could email or call the facilitation team to ask questions or provide comments, which were then passed on to the Steering Committee.

Stakeholder interviews were conducted in the spring and summer of 2010 to provide an expanded understanding of the issues of greatest importance for restoration of the habitats of the Cherokee, as well as the challenges of, and suggestions for, public participation. The list of interviewees was developed collaboratively by the CNFLRI Steering Committee to include a diverse representation of the various forest interest groups, such as fire ecologists, loggers, recreation groups, conservation and sportsmen's groups, wildlife and forest advocacy groups, researchers and local, state and federal agencies. These 30 interviews (31 people) represent the opinions held by key stakeholders prior to the CNFLRI Steering Committee reaching any findings or conclusions and are a 'snapshot in time' used to inform the Steering Committee's work and the approach to public engagement. The report is available at http://www.communityplan.net/cherokee/background.htm. The on-line questionnaire was posted on the project website for several months and was open to anyone interested in helping to prioritize key

issues or the CNF. It was also sent to past meeting participants and constituencies of Steering Committee members.

Three introductory public meetings were held in October 2010 in the towns of Erwin, Del Rio and Shady Valley. These meetings provided both an overview of the Steering Committee's process to evaluate habitat restoration needs and an opportunity for surrounding communities to share their perspectives. The USFS sent a mailing to the more than 3,000 adjacent landowners to inform them of the process and invite them to attend these meetings. In April 2011, another public meeting was held to provide an update on the Steering Committee's work and to present initial findings about forest conditions. A final public meeting was held in Erwin in September 2011 to present the committee's recommendations for restoring the habitat and related resources and to solicit public input. To allow the public additional opportunity to review and comment on the report, it was posted on the CNFLRI website through November 11th, 2011. The Steering Committee then spent three meetings reviewing and responding to the public comments (November 10th, December 5th, and January 24th).

Benefit to Local Economies

Successful implementation of the recommendations in this document would have numerous benefits to communities surrounding the CNF. The CNF already provides invaluable clean water, recreation, food, wood fiber and scenery to local communities and forms the backbone of rural tourism in East Tennessee. The recommendations in this document are intended to enhance and improve all of these benefits. Furthermore, increased fire management would give local communities more protection from wildfire.

Additionally, these recommendations aim to improve habitat for many rare species and game species, such that hunting and fishing opportunities in the CNF would be maintained and, in some cases, improved, while non-game species would also benefit. Because fishing and hunting are two of the most popular pastimes in the United States, economic benefits are expected from sportsmen travelling to local

communities to pursue those activities.

Finally the management activities required to accomplish the goals in this document would result in the harvest of trees, which would be made into products that would create and sustain local professions. Thus, the Steering Committee believes that the restoration of the Cherokee National Forest will noticeably enhance many of the economic activities associated with it.

METHODOLOGY

Formation of the Steering Committee and List of Participants

Representatives from the participating stakeholders served on a Steering Committee whose purpose was to oversee development of this process. The Steering Committee members were invited to participate in the process by the Tennessee Chapter of The Nature Conservancy. The original members were chosen by The Nature Conservancy, with input from the CNF. Once established, the Steering Committee was asked to conduct a self-assessment, at which time three members were added to ensure a broad representation from all stakeholder constituencies. The Steering Committee developed the case statement and objectives for the process, approved the use of the E-CAP tool, reviewed all the work products and helped to write the final document.

Steering Committee representatives were:

Geoff Call, US Fish and Wildlife Service
Dennis Daniel, National Wild Turkey Federation
John Gregory, Tennessee Wildlife Resources Agency
Steve Henson, Southern Appalachian Multiple Use Council
Josh Kelly, Member at Large- Environmental Community
Dwight King, Sullivan County Commissioner/Logger
Joe McGuiness, Cherokee National Forest
Katherine Medlock, The Nature Conservancy
Catherine Murray, Cherokee Forest Voices
Steve Novak, Wildlaw (Until May 31st, 2011)
Danny Osborne, TN Dept. of Agriculture, Div. of Forestry
Terry Porter, Tennessee Forestry Association
Mark Shelley, Southern Appalachian Forest Coalition
Parker Street, Ruffed Grouse Society

Methodology Overview

Enhanced Conservation Action Planning (E-CAP) is a scientific process that engages stakeholders. The following methodology is based largely on it, as it provides, "Enhanced conservation action planning: Assessing landscape condition and predicting benefits of conservation strategies" (Low, Provencher, and Abele, *Journal of Conservation Planning*, Vol. 6 (2010) 36-60), with some modifications that are described in the text.

During 2011, the Steering Committee of the Cherokee National Forest Landscape Restoration Initiative held a series of six day-long workshops to review mapping products, provide input on ecological models, and identify and refine restoration management strategies. We assessed the current condition of ecological systems in the project area as compared to their natural range of variability (NRV), using a measure of ecological departure for each system. We developed alternative management scenarios for

nine priority ecological systems using the Vegetation Dynamics and Development Tool software (VDDT, by ESSA Technologies, Ltd). We used VDDT to forecast future conditions over both 20- and 50- year time horizons, and compared the results of alternative management scenarios to those results, if we assumed no management. Finally, we prioritized our restoration recommendations utilizing a cost-benefit analysis and consensus-based discussions amongst the Steering Committee, with input from Forest Service personnel and the public.

Reviewing the LANDFIRE Biophysical Settings Models

The Steering Committee chose to use LANDFIRE Biophysical Setting models (BpS) to help determine its restoration goals. LANDFIRE BpS models are based upon pre-European settlement conditions and are generated via a peer-review process. LANDFIRE is a modeling tool that describes the disturbances (not only fire) found in each ecological system.

Reflecting the diversity of the ecological systems in the Cherokee National Forest, some of the systems described have very little disturbance, while others suggest relatively larger amounts. For example, the Low Elevation Pine, Montane Pine and Dry Oak BpS models show that fire is a driving force in these systems, while it is very infrequent in Cove Forests, Northern Hardwoods and Spruce Fir systems.

Please see Appendix H for a review of the ecological systems used for this process and the relative amounts of disturbance described for each one.

For more information about LANDFIRE, how the data was obtained and how it can be used, please visit http://www.landfire.gov/index.php.

The Steering Committee reviewed those LANDFIRE Biophysical Setting (BpS) models that occur on the North Zone of the CNF and determined that some modifications would improve their accuracy for use in this specific location. The Steering Committee also asked scientists and ecologists from across the region to review these models and provide suggested revisions.

The Steering Committee is indebted to the volunteer work of each of the following individuals for reviewing and modifying the BpS models:

Peter Bates, University of Western North Carolina
Margit Bucher, The Nature Conservancy, NC Chapter
Wayne Clatterbuck, University of Tennessee
Steve Croy, US Forest Service, George Washington/Jefferson National Forests
Jon Evans, University of the South
Cecil Frost, University of North Carolina at Chapel Hill
Katie Greenberg, USFS Southern Research Station
Henri Grissino-Mayer, University of Tennessee
Justin Hart, University of Alabama
Rob Kline, National Park Service
Charles LaFon, Texas A&M University
David Loftis, USFS Southern Research Station
Craig Lorimer, University of Wisconsin
Henry McNab, USFS Southern Research Station
Ken Smith, University of the South
Chris Ulrey, Blue Ridge Parkway
Tom Waldrop, USFS, Southern Research Station

The following revisions were made to the LANDFIRE BpS models and descriptions; these models, as revised, can be found in Appendix H:

- Increase in the historic fire size in the low-elevation pine system description.
- Decreased the percentage of fires in the low-elevation pine system that were considered 'replacement' fires and increased those considered 'mixed.'
- Creation of an entirely new BpS model that experts believed better described the conditions of oak forests in the CNF. The new model is called Montane Red-Chestnut Oak and can be found in Appendix H.
- In order to represent old-growth conditions, new classes (Old-open and Old-closed) were created within the VDDT model software for all three oak systems, as well as the Cove Forest system.
- Adjustment of some fire and wind/weather disturbance intervals in the oak systems and species composition, as well as age classes and canopy cover breaks within vegetation classes, to better reflect local ecological conditions.
- Modification of the NRV percentages for Cove Forests by one percentage point (Early from 4% to 5% and Old growth from 38% to 37%) to reflect the consensus of the Steering Committee.

Mapping Biophysical Settings

The LANDFIRE program has developed maps of the biophysical settings for the entire United States (Rollins 2009). To refine this map data for the purpose of developing detailed land management recommendations at the scale appropriate for this
E-CAP process, we used three methods to produce our Ecological System maps (found in Appendix B):

- digital elevation and terrain models, which describe environmental factors such as elevation, slope and aspect.
- digital models of geology and precipitation, and
- field verification of these environments and current ecological system occurrences.

During the winter of 2010/2011, each major ecological system of the North Zone of the CNF was mapped using the methodology developed by Steve Simon and described in *Ecological Zones in the Southern Appalachians; First Approximation* (Simon, Steven A.; Collins, Thomas K.; Kauffman, Gary L.; McNab, W. Henry; Ulrey, Christopher J. 2005., Res. Pap. SRS-41. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 41 p.). The final report of this work can be found in Appendix J.

Mapping Current Vegetation Succession Classes

In order to conduct our assessment, we needed to map the ecological systems across the landscape and determine the vegetation succession classes (S-Class) of those systems. S-Classes are defined based on the age, composition and structure of the vegetation. S-Classes for most ecological systems are generally represented as a '5 box' model; open and closed canopy old growth vegetation classes were added, as explained in the previous section. Uncharacteristic vegetation classes were also defined and mapped.

The current S-Classes of the North Zone of the CNF were determined based primarily on the Forest Service's FS Veg data, coupled with LANDFIRE canopy data. This was supplemented with additional information to help determine areas that recently became early successional habitat due to stand replacement fire and areas that have been identified as having old growth characteristics, as defined by the USFS Region 8 Old Growth Guidelines. The Early Successional Habitat information was supplied by Forest Service personnel and the Old Growth information was supplied by the Southern Appalachian Forest Coalition. A cross walk was created to convert the current condition data into the S-Classes for each ecological system. This crosswalk was created collaboratively with input from USFS personnel, Steve Simon (TNC contractor) and Jim Smith (TNC LANDFIRE Program Director).

Calculating Ecological Departure

The E-CAP process calculates ecological departure by determining the dissimilarity between an ecological system's current or projected future condition and its natural range of variability (NRV). NRV reflects the distribution of vegetation classes that would be found under naturally functioning ecological processes, as predicted by field studies, expert opinion and computer simulations, and as expressed in the LANDFIRE Biophysical Setting models.

Evaluating Current and Projected Ecological Conditions

We evaluated the current condition of nine focal ecological systems using the measure of ecological departure, based upon the data provided by S-Class mapping. We also calculated the total percentage of each system that fell into an uncharacteristic vegetation class. We then used VDDT models to simulate the projected future condition of each system after 20 years, assuming no management and continued fire suppression. Finally, we projected ecological departure and the growth of uncharacteristic vegetation, based upon the mean of five replicates.

Testing Alternative Management Scenarios

E-CAP focuses on developing restoration strategies that:

1. Enhance or restore ecological systems that are currently in an undesirable condition.
2. Abate the most serious future threats to ecological systems.

Nine ecological systems were selected for management attention, based upon their current condition and likely future departure from NRV, as well as the feasibility of management action. Working with Forest Service personnel, a comprehensive list of potential restoration strategies (hereafter called management strategies) was developed for all of the targeted ecological systems. A complete list of the management strategies that were considered can be found in Appendix B.

Examples of management strategies included prescribed fire, commercial and non-commercial thinning and harvesting, replanting, and establishing and maintaining fuel breaks. A cost-per-acre budget and potential yearly application rate were then determined for each management strategy, using the experience of local managers and stakeholders. Each strategy generally was designed to increase under-represented classes or reduce an uncharacteristic class. All management strategies were incorporated into the VDDT ecological models, showing the predicted shift of class.

The models also included a failure rate for many management strategies, since management efforts sometimes only partially succeed. VDDT model runs were then used to test and refine a suite of strategies for each of the targeted ecological systems over a 20-year time horizon (and subsequently a

50-year horizon). An initial 'strawman' set of management scenarios for each ecological system was developed by Greg Low, which included a maximum ecological benefit scenario, a fire-only scenario, a mechanical treatment only scenario, and a 'best ROI' (return on investment) scenario. The Steering Committee then suggested alternative strategies and acres-treated scenarios. Tentative strategies and budgets were refined through two day-long workshops.

The results of the alternative scenarios can be found in Appendix A. They helped the Steering Committee develop the list of recommendations found in this document. However, the number of acres treated found in each scenario, even the preferred or recommended scenario, are not designed to be prescriptive; rather, they should be used as a guide to help the Forest Service make project-level decisions and put into use an adaptive management approach.

DISCUSSION

How This Report Should Be Used

The following recommendations are intended to be recommendations to the Forest Service regarding the general direction of the management and restoration for the North Zone of the CNF. They are not designed to replace site-specific project planning or the National Environmental Policy Act (NEPA) process, but to provide a context for evaluating the expected outcomes of Forest Service designed projects with respect to those restoration priorities determined through collaboration among diverse stakeholders. The tools and models used on this project were the best available to the committee. However, they *are* only models and may not reflect conditions on the ground in every case. For this reason, successful implementation of the recommendations in this document will require ground-truthing.

The process used for this collaborative effort focused on modeling at a landscape scale—meaning the scale of the entire North Zone of the Cherokee National Forest. In order to achieve results at that scale, many of the unique habitats and rare elements that make our Southern Appalachian forests so unique and diverse were merged into nine ecological systems. The Steering Committee found this to be a level of detail that could be used appropriately for its purposes; however, its members wish to stress that such a landscape scale planning effort must not take the place of watershed and project level planning. It is at the watershed or project level that many elements of biodiversity will be captured and where appropriate management action, or avoidance, can be taken.

Additionally, the recommendations in this report focus on those areas of active management that the Steering Committee found collaborative agreement on. The report is not intended to be a statement about the merits of active over passive management. It is simply a reflection of the fact that the focus of this collaborative effort was on those areas of the CNF most in need of action; therefore, the following recommendations are designed to produce active results. There will, and should be, areas of the CNF where these active management techniques will be employed, and areas where passive restoration will be used. However, the areas determined for passive restoration have already been outlined in the Revised Land and Resource Management Plan (RLRMP) and were not revisited in this effort. Please see Appendix E for an analysis of the number of acres of each S-Class found in each RLRMP prescription area.

Uncharacteristic Vegetation Classes

Definition

Uncharacteristic vegetation classes are defined as “conditions, patterns, and processes in a given biophysical setting that would not have existed under the historical/natural range of variability, but may frequently occur today” (LANDFIRE –Landscape Fire and Resource Mgmt. Planning Tools Project, 2011).

"*Characteristic* conditions are defined as those occurring within the natural fire regime and associated vegetation (for example, low departure). Stated another way, characteristic conditions are those described in available biophysical settings models. In contrast, *uncharacteristic* conditions are those that did not occur within the natural regime, and hence produce a high departure assessment outcome. *Uncharacteristic* conditions include (but are not limited to): invasive species (weeds and insects), diseases, 'high graded' forest composition and structure (in which, for example, large fire-tolerant trees have been removed and small fire-intolerant trees have been left within a frequent-surface fire regime), or overgrazing by domestic livestock that adversely impacts native grasslands or promotes unnatural levels of soil erosion." (FRCC Guidebook version 3.0, September 2010, National Interagency Fuels, Fire, and Vegetation Technology Transfer)

Identifying Uncharacteristic Classes

Restoration needs for the Cherokee National Forest Landscape Restoration Initiative (CNFLRI) were determined from ecological departure, *i.e.*, the departure of current vegetation from its natural range of variability (NRV). Because uncharacteristic vegetation classes produce such a high landscape departure assessment, they were examined closely for the CNFLRI by using the best available information on the distribution and abundance of both current vegetation and modeled historical vegetation, in order to evaluate the dissimilarity between historical and current vegetation classes. The primary data sources used for this evaluation included the Biophysical Settings model descriptions, the mapped Biophysical Settings/Ecological Systems, and mapped existing vegetation types (forest type) from the USFS FS VEG and GIS coverage. The extent of uncharacteristic classes (U-Class) was determined through a simple map overlay/intersection of forest types (current vegetation) and ecological systems (historical vegetation).

The most extensive U-Class (nearly 12,000 acres) on the CNF North Zone occurs in Pine ecological systems (Montane Pine-Oak, Low Elevation Pine), where decades of fire suppression have resulted in a near complete loss of fire-dependent pines and a corresponding dominance by hardwoods, especially oaks, red maple and sourwood. For the purpose of determining NRV departure, these conditions were identified wherever hardwood-dominated forest types (Forest Type 53, 56, 60, 52, 59, 55, or 54) occurred on landscapes modeled to have historically supported Pine ecological systems.

The second most extensive U-Class (about 6,000 acres) on the CNF North Zone occurs in the Cove and Oak ecological systems (Southern and Central Appalachian Cove Forest, Allegheny-Cumberland Dry Oak Forest and Woodland, Southern Appalachian Oak, and Montane Red Oak-Chestnut Oak), where the current white pine canopy cover exceeds 70%. This condition is likely a result of long-term fire suppression in oak systems and has favored white pine, a prolific seed producer with intermediate light tolerance and high regeneration success in an environment lacking periodic fire that would otherwise kill or control newly established pines. For the purpose of determining NRV departure, these conditions were identified wherever white pine (Forest Type 3) occurred on landscapes modeled to have historically supported Hardwood ecological systems.

Forests having greater than 70% cover of yellow poplar on landscapes that historically supported Oak ecological systems, and to a lesser extent Pine ecological systems, were also considered 'uncharacteristic' (about 2,400 acres). Similar to uncharacteristic white pine, this condition is probably a result of long-term fire suppression that has favored a species (yellow poplar) that is both a prolific seed producer and very successful at regeneration (including sprouting) in a variety of light conditions, but is highly susceptible to fire in its seedling and sapling stages. For the purpose of determining NRV

departure, these conditions were identified wherever yellow poplar (Forest Type 50) occurred on landscapes modeled to have historically supported all ecological systems except Cove Forests.

The pine-dominated current conditions on some landscapes that historically supported Oak ecological systems (about 3,700 acres) resulted from farm abandonment, unsustainable harvesting and uncontrolled fire prior to National Forest ownership. The combination of extensive, historical timber harvesting and catastrophic wildfires has resulted in the pine-dominated current conditions on some landscapes that historically supported Oak ecological systems. For the purpose of determining NRV departure, these uncharacteristic conditions were identified wherever the Yellow Pine forest types (#'s 39, 38, or 32) occurred on Allegheny-Cumberland Dry Oak Forest and Woodland, Southern Appalachian Oak, or Montane Red Oak-Chestnut Oak ecological systems.

Two additional minor uncharacteristic conditions were identified: (1) where shrubs are currently dominating forest or woodland ecological systems, and (2) where the current hardwood canopy cover exceeds 70% on landscapes that historically supported Spruce ecological systems.

Restoration of Ecological Systems

The restoration of ecological systems is recommended to be accomplished in two ways:

1. Manipulating existing S-classes of characteristic vegetation to better mimic the Natural Range of Variability.
2. Restoring systems that are currently uncharacteristic to the proper ecological system for the site conditions.

It is recommended that manipulating existing S-classes be accomplished through a combination of vegetation treatments and fire, where appropriate. Restoring Uncharacteristic Vegetation Classes to their proper ecological system is considered a high priority in the CNF North Zone because they contribute greatly to the ecological departure score for each system. Restoration of areas containing uncharacteristic classes will be complex, especially in areas that are lacking a sufficient seed-source.

RECOMMENDATIONS

S-Classes and Biodiversity

The Enhanced Conservation Action Plan (E-CAP) methodology employed by the Steering committee uses S-classes to evaluate the current condition of the nine broad forest types examined versus the predicted natural range of variability (NRV) for those forest types over the 1,000 years prior to European settlement. S-classes are stages of forest development with discreet *successional* and *structural* phases – hence the **S** in S-class. Five-to-six S-classes were applied to each of the nine forest types considered: early, mid-closed, mid-open, late-closed, late-open and old-growth.

Forest succession is an ecological concept describing how forest communities form and develop following a disturbance, such as a wind storm or fire. The disturbance kills some canopy trees, allowing more light to reach the ground and initiating regeneration and growth of trees, shrubs and herbs with high light requirements. The seedlings become a dense stand of saplings, which compete until some become small trees. Only a fraction of tree seedlings ever become canopy trees, while the rest are outcompeted by their neighbors. Finally, after many decades, the forest progresses through all its successional stages.

Different phases of forest succession have varied structural characteristics. Areas of forest in early development have dense thickets of regenerating trees. Mid-successional forests tend to have fast growing trees and a relatively homogenous structure. A moderately intense disturbance, such as a fire, can open up mid-successional forests, diversify the ages of trees, and create a more heterogeneous habitat. By late succession, canopy trees are large, but still mostly of one age.

Like mid-successional forests, scientific information evaluated by the committee indicates that many areas of late-successional forest in Pine and Oak ecosystems were once more open because of more frequent fire. When canopy trees from the last large disturbance begin to die, the forest enters an old-growth condition, the most important structural attributes of which are large quantities of downed wood, snags, hollow trees, large tree-fall gaps, and pit and mound topography. Original old-growth forests in the Cherokee National Forest were uneven-aged, with large, old trees often touching crowns with younger trees.

Many species of animals, plants, fungi and other wildlife are specialists that are restricted to, or find, their optimum habitat in particular S-classes. Specialist wildlife species are of particular interest to conservationists for two reasons. First, they account for most of the biodiversity on Earth; and second, they are more vulnerable to habitat changes than generalist species.

Notably, on the North Zone of Cherokee National Forest, the S-classes that are most abundant in all forest types are mid-closed and late-closed, and these are the S-classes that provide the least benefit for specialist wildlife species because of their relatively low level of structural complexity. Early, open and old-growth S-classes are below their natural range of variability in all forest types based on the results of E-CAP. These are also the S-classes with the highest number of specialist wildlife species.

The Steering Committee acknowledges the value of all S-classes in maintaining biodiversity. One of the key aims of this initiative is to bring all forest types and their S-classes within the natural range of variability. Because they are currently below that range, many management recommendations by the Steering committee are aimed at increasing the amounts of early, open and old-growth S-classes on the North Zone of Cherokee National Forest.

- In order to protect the value of old growth forests at the watershed level, the USFS should give preference to harvesting stands in the over-abundant mid and late age classes and continue to follow Region 8 Guidance on Protecting and Restoring Old Growth Forests.

Recommendations by Ecological System

The Steering Committee made recommendations for each of the nine ecological systems that were modeled on the North Zone of the CNF. In addition, several scenarios were modeled for each of the ecological systems. The scenario referred to as U-B-Gone was so-named because, in addition to its outcome of restoring the ecological systems that are currently in an undesirable condition, it also focuses on abating the most serious future threats to ecological systems by concentrating on the 'U' or 'uncharacteristic' classes found on the Cherokee National Forest.

The following recommendations are based on the scenarios presented as annual outcomes in the U-B-Gone VDDT model runs for each of the systems (Appendix A). Figure 1 shows the Ecological Departure scores for each of the nine ecological systems in four scenarios: current conditions: under minimum management conditions after 20 years; after U-B-Gone restoration treatments over 20 years; and after U-B-Gone restoration treatments over 50 years.

While the Steering Committee does not expect that the exact scenarios expressed in these runs will be achieved every year, we encourage the Forest Service to use them as a guide for designing projects that, over time, would restore the ecological systems to the relative proportions recommended by this committee.

Ecological System	Acres (rounded to nearest 100)	Ecological Departure			U-B-Gone Mgmt - 50 Years	U-B-Gone Mgmt - Ave. Annual Cost over 50 Years
		Current Condtion	No Mgmt w Fire Suppression	U-B-Gone Mgmt-20 Years		
Cove Forest	103,000	47	34	29	18	$ 22,500
Dry Oak Forest	65,900	61	60	37	29	$ 112,100
Dry-Mesic Oak Forest	40,800	54	49	34	33	$ 32,500
Low-Elevation Pine Forest	23,800	90	72	35	21	$ 93,750
Montane Pine Forest	21,800	82	80	35	22	$ 97,750
Montane Red-Chestnut Oak Forest	71,800	47	39	25	11	$ 62,550
Northern Hardwood Forest	11,600	12	14	-		
Riparian & Floodplain Systems	2,500	54	39	38	21	$ -
Spruce-Fir Forest	2,200	40	40	24	11	$ 12,000
Average Annual Cost				$ 433,000		
Average Annual Acres Prescribed Fire				4,900		
Ave. Annual Acres Commerical Harvest				1,600		

Figure 1. Ecological Departure Score Card for the U-B-Gone Restoration Scenario.

The Steering Committee tested several alternatives for each ecological system, including a minimum management scenario, a maximum ecological benefit scenario, a fire-only management scenario, a mechanical-only management scenario and several variations of the greatest ROI scenario (some systems had more scenarios created than others, please see Appendix A for a full list).

In an effort to move the vegetation S-classes in each system closer to the Natural Range of Variability, the Steering Committee agreed to key objectives for each system. The U-B-Gone approach closely reflects these objectives.

Cove Forests

The Steering Committee recognized that the creation of openings in Cove Forests was an area that needed special attention and consideration and so it appointed a subcommittee to develop recommendations. The Cove Forest system represents the largest system on the North Zone of the CNF, at over 100,000 acres. It represents some of the greatest diversity of plant and tree species and has been the subject of more controversy than many other systems. The subcommittee used information found in the LANDFIRE BpS model to inform their recommendations, but also relied upon additional readings and their own working knowledge of this system.

The subcommittee agreed that the primary means of regeneration within a Cove Forest was through gap-phase regeneration on a fine scale, although larger-scale disturbances also occur periodically within

this community. For that reason, the subcommittee recommends that the creation of openings through timber harvesting, for the purposes of restoration, should be focused on:

- The removal of uncharacteristic white pine (*Pinus strobus*) stands.
- The restoration of stands dominated by tulip poplar (*Liriodendron tulipifera*) to more diverse forests.
- The goal should be to maintain the NRV levels for all S-Classes in this system.

The subcommittee also agreed that the mechanical creation of openings in Cove Forest systems may be desirable for reasons other than restoration. Primary among these reasons is to benefit wildlife. However, Cove Forest systems are generally a sheltered system with less disturbance than other ecological systems, so care should be taken to protect the unique values found in them and not to promote one species over others. Protecting and increasing the native diversity of flora and fauna found in Cove Forests should be a primary goal when managing the vegetation of these systems. The size, type and arrangement of openings is very important and must take into consideration how to achieve the highest quality habitat for a suite of species, as well as the topography, the feasibility of harvest activities, and many other factors. In short, these decisions are best made at the project level. However, the subcommittee recommends the following guidelines:

- Openings created by mechanical means should range from two acres to 40 acres in size. Several smaller openings are more desirable than a single large opening.
- The location of openings should consider connectivity of habitat, and preference should be given to areas that are in close proximity to adjacent larger openings in other ecological systems, or those created for restoration in the Cove Forests described above.
- Mechanical creation of openings should be focused on the mid-closed S-Class in Cove Forests, between 60 and 100 years in age, because it is the only S class that is currently overrepresented in this system.
- Cove Forests are especially vulnerable to invasive plant species, which can impact the native perennial herbs found there. Therefore, when manipulating Cove Forests, measures should be taken to deter the introduction of non-native invasives. Additionally, the CNF should monitor the herbaceous layer in botanically rich Cove Forests where treatments have been conducted.

Dry Oak

In Dry Oak ecological systems, the Steering Committee recommends:

- Decreasing the percentage of the late closed-class, moving it to a late open or early condition through several treatments, including prescribed fire, regeneration harvests and woodland restoration treatments. Fire is considered a driving force in this system.
- Reducing the amount of uncharacteristic white pine and yellow poplar through prescribed burning and/or harvest and restoration treatments, with or without planting, depending upon the presence of oak in the overstory.

Dry Mesic Oak

In Dry Mesic Oak ecological systems, the Steering Committee recommends:

- Decreasing the percentage of the late closed-class, moving it to a late open or early condition through prescribed fire, and thinning and regeneration harvests.
- Reducing the amount of uncharacteristic pine and yellow poplar through various harvest and/or restoration treatments, with or without planting, depending upon the presence of oak in the overstory. Conditions may exist where a quality short leaf pine community may be favored over restoration to a Dry-Mesic Oak system. This should be determined by ground-truthing at the project level.

Low Elevation Pine

In Low Elevation Pine ecological systems, the Steering Committee recommends:

- Decreasing the percentage of the late-closed class, moving it to a late-open or early condition by prescribed fire and thinning. If the results produce too much mid-closed condition, consider more thinning of the mid-closed class to move it toward mid-open, or burning to keep it in an early condition.
- Reducing the amount of uncharacteristic oak through woodland restoration treatments and/or harvest and restoration treatments, with or without planting, depending upon the presence of pine in the overstory.
- Fire is one of the driving forces in this system and can be used to great effect for restoration purposes. However, this system is often in the Wildland Urban Interface where prescribed fire could be considered risky. Therefore, the Steering Committee has opted to include an additional treatment called “fire breaks.” Though expensive, this is a necessary safety precaution and once established will continue to provide protection for properties neighboring the National Forest, as well as some ecological benefits.

Montane Pine

In Montane Pine ecological systems, the Steering Committee recommends:

- Decreasing the percentage of the late-closed class, moving it to a late-open or early condition through several treatments, including prescribed fire and woodland restoration treatments. Fire is a driving force in this system.
- Increasing the percentage of the mid-open class by thinning and prescribed fire.
- Reduce the amount of uncharacteristic oak and restore pine in this system through prescribed burning techniques and/or harvest and restoration treatments, with or without planting, depending upon the presence of pine in the overstory.

Montane Red-Chestnut Oak

In Montane Red-Chestnut Oak ecological systems, the Steering Committee recommends:

- Decreasing the percentages of late-closed class, moving it to a late-open or early condition through several treatments, including prescribed fire, gap-harvests, thinning and regeneration harvests.
- Increasing the percentage of mid-open class by prescribed fire and thinning.
- Reducing the amount of uncharacteristic pine and yellow poplar in this system by prescribed burning and/or harvest and restoration treatments, with or without planting, depending upon the presence of oak in the overstory.

Northern Hardwoods

According to the analysis done by the Steering Committee, the Northern Hardwoods system as a whole is in good condition. Therefore, it was not considered a restoration priority, and no management scenarios were tested. The Steering Committee recommended verification of the assumptions made regarding the amount of disturbance modeled in VDDT for this system through an adaptive management approach.

Riparian

The modeling used by the Steering Committee shows that this system will improve on its own through naturally caused disturbances, with little need for management. The Steering Committee recommended verification of the assumptions made regarding the amount of disturbance modeled in VDDT for this system by taking an adaptive management approach.

The Steering Committee noted that there are several additional treatments that are appropriate in Riparian systems that were not modeled. They are:

- Treatment of the exotic invasive hemlock woolly adelgid, emerald ash borer and other introduced forest pests and pathogens.
- Treatment of exotic invasive weedy species.
- River cane restoration (a rare community that is further addressed in the Threatened, Endangered and Extirpated species section).

Spruce Fir

In Spruce Fir ecological systems, the Steering Committee recommends:

- Decreasing the percentages of uncharacteristic – neither Spruce nor Fir conditions – in this system through under-planting and thinning treatments designed to speed the transition of these acres back to a Spruce-Fir dominated system.
- That, because of the possible impacts of climate change, restoration efforts should be contained to those areas at the highest elevations.

Considerations for Current and Future Planning Processes

The Steering Committee reviewed the current management prescriptions in the RLRMP of the CNF and found no restrictions that should preclude implementation of the recommendations made by the committee. However, two of the ecological systems found in high elevations (Spruce Fir and Montane Pine) may require special consideration. The majority of both of these systems found on the CNF is contained within either Wilderness or Appalachian Trail management prescriptions. The Wilderness prescription will not allow mechanical vegetation management and must therefore rely on less intensive forms of restoration. The AT prescription states that vegetation management is allowed that will not compete with the primary purpose of the prescription—to support and enhance the AT experience. Therefore, when the recommendations of the Steering Committee are proposed as specific projects in these areas, we hope satisfactory compromises can be found.

The current RLRMP for the CNF states that restoration is one of the primary goals. The Steering Committee believes that the E-CAP tools (ecological system mapping, VDDT modeling, etc.) can direct that restoration in an ecologically appropriate manner and should, therefore, be used in future planning efforts.

- We recommend that these tools be consulted at a project scale, where appropriate, and that the modeling efforts be reevaluated during the next iteration of the RLRMP.

Restoration activities in Wilderness areas are limited to natural fire and non-mechanized treatments. This underscores the importance of preparing plans that would enable the Forest Service to monitor, rather than suppress, wildfires burning in places where they could advance ecological restoration goals while not endangering public safety.

- We recommend that Wildland Fire Management plans be produced for all of the Wilderness Areas in the North Zone of the CNF.

In full compliance with NEPA or any other environmental laws, we recommend that early stakeholder engagement and education can enhance the public participation process and go a long way toward avoiding conflict over projects between the USFS and public stakeholders. The integration needs to be accomplished in an ongoing and collaborative manner, through such approaches as data sharing maps, field visits, distribution of GIS data, websites, and meetings where staff and citizens share information in an interactive problem-solving mode.

CNFLRI recommendations do not propose a replacement for the National Environmental Policy Act (NEPA) or any other environmental laws, but should, through early stakeholder engagement, uphold and complement the NEPA process, enhance public participation, increase opportunities for input and ultimately improve project development. This will provide for a more collaborative approach and go a long way toward avoiding conflict over projects between the USFS and public stakeholders.

Watershed Approach

Few habitats in Southern Appalachian forests have suffered such dramatic species loss and decline as our streams and rivers; aquatic species are the most threatened of all species groups in the Southeast. Rivers that flow from the CNF are some of the most biologically rich waters in the world. Clearly, protecting the headwaters of the CNF is a necessity if we are to protect the aquatic diversity of the region. While intact watersheds are clearly needed to protect aquatic life and to provide habitat and corridors for movement of terrestrial species, they also provide clean drinking water for human populations.

The U.S. Department of Agriculture (USDA) Strategic Plan for FY 2010–2015 targets the restoration of watershed and forest health as a core management objective of the national forests and grasslands. To achieve this goal, the Forest Service, an agency of the USDA, is directed to restore degraded watersheds by strategically focusing investments in watershed improvement projects and conservation practices at the landscape and watershed scales.

The Watershed Condition Framework (WCF) is a comprehensive approach for classifying watershed condition, proactively implementing integrated restoration in priority watersheds in national forests and grasslands, and tracking and monitoring outcome-based program accomplishments for performance accountability. (More information about the WCF can be found in Appendix G.)

The most effective way to approach complex ecological issues is to consider them at the watershed level, where the fundamental connection among all components of the landscape is the network of streams that defines the watershed. Watersheds are easily identified on maps and on the ground, and their boundaries do not change much over time. Watersheds are also readily recognized by local communities and resonate with members of the public as a logical way to address resource management issues.

Watersheds are integral parts of broader ecosystems and can be viewed and evaluated at a variety of spatial scales. Because watersheds are spatially located landscape features uniformly mapped for the entire United States at multiple scales, they are ideal for tracking accomplishments, both in terms of outputs (acres treated on the ground) and outcomes (improvement in watershed condition class). To avoid double counting, we report accomplishments and outcomes by each watershed's unique hydrologic unit code (HUC). A watershed's condition class integrates the effects of all activities within a watershed; therefore, watersheds provide an ideal mechanism for interpreting the cumulative effects of a multitude of management actions on soil and hydrologic function.

Finally, many hydrologic and aquatic restoration issues can be properly addressed only within the confines of watershed boundaries. Watersheds provide an excellent basis for developing restoration plans that can treat a multitude of resource problems in a structured, comprehensive manner.

The Steering Committee recommends:

- The Forest Service should continue to plan restoration projects at the watershed scale. The Steering Committee also recommends that the watersheds are the most appropriate scale at which to measure the success of restoration.
- The Forest Service currently works to reintroduce and augment populations of aquatic species, where appropriate. The Steering Committee encourages these efforts and would seek to increase them when possible.

Forest Pests and Pathogens

There are many forest pests and pathogens that currently pose a threat to the CNF, such as the gypsy moth and hemlock woolly adelgid. There are an even greater number of pests and pathogens that are likely to impact the CNF within the next 20 years, such as the emerald ash borer, thousand canker disease, gypsy moth and others yet to be discovered.

Because our modeling focused on estimating the natural range of variability, and these non-native pests and pathogens are novel to the Southern Blue Ridge and predictions of their effects are imprecise, they

were not considered as disturbances in the models used for this process. Excluding these does not reflect a bias or lack of concern among the Steering Committee, only the limitations of the tools available to us. In fact, the Steering Committee expressed concern about all of these pests and pathogens. Some specific concerns and unanswered questions include the unknown type and arrangement of early successional habitat created by dead and dying trees, the need to provide funding for very costly treatments to protect our trees at a landscape scale, and even the difficulties of monitoring the spread of these pests. Each pest or pathogen could merit the time and attention of a planning effort devoted solely to it.

In lieu of that level of detail, the Steering Committee offers the following recommendations:

- Implement an early detection and rapid response framework for surveillance, monitoring and treatment of invasive species. The Steering Committee encourages the Forest Service to adopt this method whenever possible and to engage adjacent landowners to help in this effort (this process provided a list of adjacent landowners that can now be used to contact them via mail).
- Fully implement the plan and approved Environmental Assessments for treatment of the hemlock woolly adelgid and the control of non-native invasives. This will require more funding than is currently available.
- Continue monitoring efforts for the emerald ash borer, thousand canker disease, and other pests and pathogens.
- Continue spot treatments the gypsy moth and prioritize those recommendations in this document that address thinning or regenerating closed canopy Oak systems.
- The Forest Service should continue to participate in the “Don’t move Firewood” campaign and consider posting signs and providing information to visitors that instructs them not to move firewood and the reasons why they should not.
- Similar to the “Don’t move Firewood” campaign, the Steering Committee encourages the Forest Service to educate visitors about the potential negative impacts of moving bait (minnows, crayfish and worms).
- Continue to implement an equipment sanitation program to limit the movement of invasive species among sites within CNF and the surrounding region by Forest Service vehicles, logging equipment, and Forest Service and contractor personnel.

Effects on Threatened, Endangered and Extirpated Species

Currently, the CNF is home to 182 Threatened, Endangered and Sensitive species. There are several hundred additional species that are considered of viability or conservation concern on the North Zone. Lists of these species can be found in Appendixes E and F of the *Final Environmental Impact Statement* of the CNF RLRMP. Collectively, we refer to these as species of conservation concern. These species include amphibians, birds, fish, mammals, freshwater mussels, snails, reptiles, several arthropods (insects, arachnids, millipedes), and plants (both vascular and non-vascular).

The Endangered Species Act directs all federal agencies to utilize their authorities to carry out programs for the conservation of endangered and threatened species. In many cases, restoration of the forested habitats that the Steering Committee assessed on the North Zone using the E-CAP framework will result in positive habitat gains for species of conservation concern. However, we could not use E-CAP to analyze some small-patch, discrete and rare communities across the National Forest, such as balds,

bogs, rock outcrops, seeps and springs, which are home to a great number of the rarest species on these lists, including some federally listed species.

Therefore, the Steering Committee makes the following recommendations to address the needs of species of conservation concern:

- Emphasize restoration of rare communities across the North Zone of the CNF.
- Explore additional opportunities for programmatic approaches for continued compliance with the Endangered Species Act and other environmental regulations, in order to expedite project-level reviews and minimize planning delays.
- Use products produced by the CNFLRI process (such as Steve Simon's ecological system mapping), in conjunction with species occurrence data and the TWRA's State Wildlife Action Plan, to help inform watershed level restoration planning and maximize the potential for restoration projects to benefit species of conservation concern.
- Continue Rare Community Restoration planning efforts and develop partnerships to implement management projects to address restoration needs.
- Continue to participate in, and support, efforts to restore and augment native species that have been extirpated from the North Zone of the CNF (such as the American Chestnut).

Historical Photos of American Chestnuts in the Southern Appalachians

Tremont, Great Smokey Mountains National Park. Tennessee

Tremont, Great Smokey Mountains National Park. Tennessee

Unicoi Mountains, North Carolina

Economics, Feasibility, and Contracts

As noted in the Methodology section, the estimated costs for implementing management treatments on the CNF were based on the best available estimates, but do not reflect the potential market values of the timber harvested during these treatments, which could reduce net costs to the Forest Service for some treatments. The Steering Committee found it difficult to predict the future marketability of wood products over the next 20 years because this can be affected by so many unforeseen variables (the housing market, biofuels market, and many others). Therefore, the return on investment (ROI) numbers are based solely on the amount of cost to the Forest Service, regardless of timber revenues.

The Steering Committee agreed that restoration activities could produce marketable products and that the Forest Service should design projects to capitalize on market fluctuations when doing so would result in ecologically and economically viable restoration practices. The Steering Committee recognized that some restoration treatments may be more marketable than others, depending on many factors, such as the site index and species composition, the accessibility of the site, and the size of the treatment area.

The following recommendations are intended to encourage design of restoration projects that result in marketable products:

- When feasible, package less marketable treatments with those that have a higher value. This is particularly true when a site is 'marginal' in value and the addition of more valuable products in adjacent restoration areas could entice operators to participate in the sale.
- Being responsive to fluctuations in timber markets requires relatively quick action. Therefore, the Forest Service should explore the possibility of extending the window of opportunity for project implementation. This would allow projects to 'sit on the shelf' until markets are favorable. Some restoration activities may simply not have commercial value and will need to be done as service contracts rather than as timber sales. This will require traditional timber operations to be open to different contract situations and means of operation. The Forest Service should work to promote and encourage operators to participate in these types of contracts (also see Stewardship Contracting below).

Stewardship Contracting

Due to a number of factors (including Agency budgets, and office downsizing), employment opportunities and project implementation within the national forest system have witnessed a steady decline. Despite these reductions, the need for restorative work clearly remains paramount.

Such work includes: watershed restoration and maintenance, road obliteration for sediment control, wildlife habitat improvements, fuel load reductions, timber stand improvements and insect/disease protection. In the past, these stewardship projects were completed largely within the confines of timber sale contracts and performed by an independent contractor or smaller sub-contracting firms. Revenues generated within these sales provided the funds necessary for stewardship work. However, with the marked decline in the federal timber sale program, available funds for such work have declined as well. Limited appropriations from Congress and restricted money within existing trust funds have further exacerbated the situation.

Given the economic challenges for accomplishing restoration work, creative approaches must be utilized to complete the necessary work and simultaneously contribute to the economic growth of local, rural communities.

Stewardship End Result Contracting (stewardship contracting) is a relatively new tool available to the U.S. Forest Service for managing and restoring federal lands. It is a system that could allow more creativity in designing economically and ecologically viable restoration projects. With stewardship contracting, the Agency can more completely address the total ecological needs of an area by using timber sale contracts, service contracts, agreements and newly integrated resource contracts—or any combination thereof. The Agency describes the 'end result' it wants to achieve in a certain area and its contractor develops and implements a mutually agreed-upon plan to achieve that goal. Stewardship contracting also allows the Agency to enter into multi-year contracts and to use the value of any products removed and sold as a by-product of the restoration or maintenance work, in order to offset some or all of the costs of the work. Finally, with stewardship contracting, the Agency can work with the local community to design and implement the contract, and in the process, build community capacity and bring jobs and income into the local community.

(Please see Appendix F for a more detailed explanation of Stewardship Contracting.)

Roads

There are over 688 miles of designated roads on the North Zone of the CNF and many more miles of non-system legacy roads and user-created motorized trails. Properly constructed and maintained roads can make management of the forest more efficient and provide motorized access for forest users. However, roads that do not meet those criteria can cause resource damage from erosion, illegal access and poaching, and can be vectors of dispersal for non-native plant and animal species.

The maintenance of Forest Service roads depends largely on budgetary allocations, which are erratic and have declined in the past 20 years. There are national-level directions for each Forest Service unit to:

- Identify the minimum road system needed for safe and efficient travel and for the protection, management and use of NFS lands.
- Identify roads that are no longer needed to meet forest resource management objectives and, therefore, are scheduled for decommissioning or to be considered for other uses (36 CFR 212.5(b)).

Because of the potential of roads to impact water quality, there are directives from within the Forest Service that each National Forest integrate transportation analysis with the Watershed Condition Framework:

"[U]nits should seek to integrate the steps contained in the Watershed Condition Framework (WCF) with the six TAP steps contained in FSH 7709.55, Chapter 20, to eliminate redundancy and ensure an iterative and adaptive approach for both processes. We expect that the WCF process, and especially the initial watershed condition assessment (Step A) which has been completed will provide important information for your work on Subpart A, while the TAP process will likewise provide information for the WCF process."

The Steering Committee recommends that CNF follow national directions and make a priority of identifying the minimum road system needed to manage the forest with the funds available. Roads that

are poorly constructed, causing erosion damage, or are redundant, should be scheduled for repair or decommissioning.

For those roads that are retained as part of the minimum road system, proper management is essential. Increased law enforcement is needed to decrease illegal vehicle use on closed roads and by 'trail blazers' off-road. In situations where legal or illegal uses have caused erosion, the Steering Committee recommends working with partner groups to repair damage and plant native vegetation that is beneficial to wildlife. Several wildlife species benefit from the vegetation on roads managed as linear wildlife openings. When these roads are improperly or illegally used, this important vegetation can be damaged, as well as wildlife that benefits from this habitat. It is especially important that linear wildlife openings be kept closed to traffic during spring and early summer to benefit a suite of wildlife species, including the ruffed grouse, wild turkey, and deer.

Biomass and Biofuels

Recently, biomass and biofuels have garnered much attention throughout the world as potential sources of energy to wean us from fossil fuels (oil and coal) and reduce carbon dioxide emissions. During our contemplation of restoration activities on the CNF we tried to ascertain the impact that biomass and biofuel markets might have on any potential activities we recommend.

For the purposes of this discussion we will define biomass as plant materials derived from whole trees, including stems, bark, leaves and roots. Biofuels are fuels derived in some way from biomass—solid biomass, liquid fuels and biogases.

To date, most of the development of biomass and biofuels has been driven by government policies (at all levels), since biomass and biofuels cannot currently compete with conventional energy sources in delivered price on a large scale. However, as oil and coal prices continue to rise, government policies change, and new developments in biofuel production become commercially viable, biofuels may be able to better compete in the not-too-distant future.

Biomass markets in the Southeastern region are not strong at the present time and are impossible to predict with any certainty. We believe the markets will be determined in the near future by developments in the electric utility sector. Over the past couple of years, some public electric utilities in the Southeast, driven by government policy, have announced plans to convert some coal-fired electricity generating plants to biomass or a combination of biomass and coal. There are other companies, working in cooperation with established public utilities that have announced plans to develop biomass electricity generating facilities in the region as well. However, some of these plans have been delayed or abandoned, primarily because of a constantly changing government policy environment. This uncertainty makes it impossible to project what effect these developments will have on biomass markets in the region.

In the Cherokee National Forest, government policies will have the most significant impact on potential sources for biomass and biofuel production. Most recent government policies pertaining to energy development are centered around "renewable sources" to replace the nonrenewable oil, coal and nuclear sources of energy. As the debates over what is a "renewable source" have developed, some have argued that trees should not be considered a "renewable source" in policies directing energy development. Others argue that utilizing biomass as an energy source will not produce a net reduction in carbon dioxide.

Public lands, including national forests, have become a side issue in the biomass debate. Language in some energy/biomass legislation and policy direction has excluded biomass products derived from public lands as qualifying as credible "renewable sources." The Steering Committee did not review these arguments, since such decisions are above its charge and will be left to future government decisions.

There is no question that some of the biomass sourced on the CNF has been utilized in energy production, such as wood boiler fuel, home fireplaces and woodstoves, but only on a small scale and as by-products of wood sourced primarily for lumber and pulpwood markets . At present, there are no specific plans to integrate any new biomass markets in the natural resource activities of the CNF, other than firewood utilization by local residents in the vicinity of the forest.

The Steering Committee makes the following recommendation:

- If it becomes financially feasible, we encourage the Forest Service to use biomass and biofuels markets to utilize otherwise unmerchantable wood products, in order to help accomplish ecologically beneficial restoration.

Climate Change

Climate change is already altering our nation's forests in significant ways, and those impacts will very likely accelerate in the future—in some cases dramatically. Adaptive management and a vibrant monitoring program will become critical in the uncertain environment of climate change.

Restoring the health and maintaining the resiliency of our public lands, including the CNF, is crucial for adapting to the effects of climate change. Forests work as carbon sinks—trapping carbon dioxide in the trees and the soil.

Mitigating and adaptively managing for climate change will impact those challenges the NFS currently faces for land stewardship and restoration of our national forests. A sensible, science-based management approach, which takes into account the important services these forests provide, would emphasize carbon storage and result in a healthy, resilient landscape with greater capacity to endure natural disturbances and large scale threats to sustainability—especially under changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses.

The principles provided here are designed to reflect and incorporate current science and provide for resilient forests. These principles also hold great promise for secondary benefits to wildlife, water and recreation.

We expect that management approaches will be updated as science evolves and policy develops. At this time, the following is a list of items that we recommend be addressed at the planning stages when developing restoration projects:

- Continue to use the best available science on climate change; this science should be at the geographic scale most relevant to the local planning unit and the issues it is considering.
- Address climate change during project planning so that the project unit will continue contributing to the diversity and health of the forest.
- Forests should be managed in ways that will increase their capacity to sequester and store carbon and reduce their carbon emissions.
- Place increased value on monitoring and trend data to understand actual climate change

implications for local natural resource management.

- Implement an adaptive management approach as more information is gained and better tools become available.

Implementation Analysis

Decisions on exactly where a project should take place, and the scope and scale of that project, must be made at a much finer scale than the Steering Committee was able to achieve. Our goal was to provide recommendations for restoration at the landscape-scale. However, some analysis regarding the feasibility of implementation of our recommendations was performed in order to ensure that our recommendations were achievable, as well as to get a vision of how they might play out across the landscape. The tables and maps found in Appendix D show the results of this analysis.

Each watershed that contains Forest Service lands was reviewed to see how much of each S-Class it contained. Additionally, this was overlaid with the current RLRMP (as an extension of the work described in the section above titled, Considerations for Current and Future Planning Processes). The results show the amounts and arrangements of locations within the "suitable timber base," as described by the current RLRMP, that are in a mid/late-closed condition or are a U-Class. Both mid/late-closed and U-Classes were targeted for restoration treatment by the Steering Committee.

Financial Support for Recommendations

The Steering Committee has recommended the U-B-Gone scenario because it was most acceptable to the committee overall:

- Estimated annual costs for implementation of U-B-Gone for the North Zone of the CNF restoration recommendations is $433,000.

The scenarios that were considered by the Steering Committee represent a wide range of costs—from approximately $277,000 annually to $1.58 million annually (for details of these costs, please refer to Appendix A). These costs do not account for any timber revenues generated by project implementation.

The Steering Committee recognizes that the current workload of the Forest Service staff would hinder them from fully implementing the U-B-Gone scenario. Therefore, we recommend the addition of 3 permanent staff to increase capacity for on-the-ground implementation:

- Estimated annual costs for additional staff to implement U-B-Gone restoration recommendations is $141,000 ($47,000 annually per new employee).

In addition to the costs outlined above, the Steering Committee made several recommendations about various issues pertaining to restoration that were not modeled by VDDT. The following is an effort to estimate the costs of these additional recommendations. In each case, the numbers are an estimate and based on current conditions, and not adjusted for any future fluctuations in the economy:

- Recommendation #1 for Forest Pests and Pathogens states, "Implement an early detection and rapid response framework for surveillance, monitoring, and treatment of invasive species. The Steering Committee encourages the Forest Service to adopt this method whenever possible and to engage adjacent landowners to help in this effort (this process provided a list of adjacent landowners that can now be used to contact them via mail)." Implementation of this recommendation would likely result in an additional staff person on the North Zone of the CNF

dedicated to non-native invasive species control. The estimated cost would be $58,000 annually (one GS9 employee).

- Recommendation #2 for Forest Pests and Pathogens states, "Fully implement the plan and approved EAs for treatment of hemlock woolly adelgid and for the control of non-native invasives. This will require more funding than is currently available." Funding for treatment of HWA and other non-natives is approved annually for the whole Forest. Therefore, any requests specifically for the North Zone should not be confused with total annual requests for the whole Forest. Full implementation of the EAs within the North Zone should cost approximately $290,000 per year. $200,000 of that total is for treating approximately 400 acres of hemlock. The remaining $90,000 is for treating approximately 300 acres of non-native invasives.
- The restoration actions recommended by the Steering Committee will result in additional canopy and road openings throughout the North Zone of the CNF. Additional openings are often opportunities for illegal incursions or vandalism on the CNF. Therefore, the Steering Committee strongly recommends increasing law enforcement and mechanisms to prevent illegal activity. There are several ways this could be achieved, but all have an associated cost.
- Rare Community restoration was a priority for the Steering Committee, and there is a need for additional funding in order to manage these discrete communities. Each one will require specific treatments, and the cost will vary depending upon the necessary treatment. However, we recommend that the Forest Service spend between $25,000-$50,000 per year restoring rare communities.

Monitoring and Adaptive Management Approaches

The CNF RLRMP states that adaptive management is foundational for planning and RLRMP implementation in a dynamic environment, in order to account for changed resource conditions, new information or science, or new regulations or policies. The RLRMP also recognizes that monitoring and evaluation are distinct key elements of managing adaptively, which can lead to adjustments of programs, projects or activities, changes or amendment to the RLRMP itself, or be used to recommend changes in laws, regulations, and policies that affect both the RLRMP and project implementation. Three types of monitoring are described in the RLRMP:

- Implementation monitoring – addressing whether the RLRMP is being carried out.
- Effectiveness monitoring – assessing whether the program has resulted in the desired conditions.
- Validation monitoring – determining if information used in developing the LMP has changed.

The Steering Committee agrees with this approach and therefore proposes the following multi-level monitoring strategies.

Implementation

The Steering Committee has designated a small group of its members to monitor the implementation of the recommendations of the Steering Committee. This small group will assess whether or not projects are being proposed and implemented and report back to the full Steering Committee. It will pay particular attention to the first project proposed in each of the nine ecological systems. The Steering Committee will reconvene in approximately 18 months from the date of the publication of this report to

hear from its members. At that time, the Steering Committee will also determine the appropriate interval for subsequent meetings to hear from the group.

Effectiveness and Validation

The recommendations of this Steering Committee are intended to guide the implementation of ecological restoration efforts and are based on the E-CAP framework, which identifies the NRV for ecological systems on the CNF, recommends management strategies, and estimates those departures from NRV predicted by the VDDT model that will result from applying the various management strategies to the forest's ecological systems.

Uncertainty is inherent when modeling ecological systems, predicting their NRV, assessing current conditions and predicting responses to management strategies. The USFS and the Steering Committee will need to monitor and evaluate the effectiveness of the restoration recommendations and opportunities for adapting them when there is a need to do so. To do that, the USFS will need to develop an adaptive management framework. And key to that process will be to explicitly acknowledge the uncertainty the Steering Committee faced in developing its recommendations.

In order to ensure that a monitoring and evaluation framework is developed to adaptively manage ecological restoration in the CNF, the Steering Committee recommends that, the CNF, in coordination with the Steering Committee, does the following:

- Redoes the modeling to update the Ecological Departure scores for the North Zone of the CNF before or during the next Land and Resource Management Plan revision process, allowing as much time as possible for implementation of the recommendations before the modeling is done.

1) Works with the Watershed Team commissioned by the Steering Committee to establish appropriate monitoring questions. Once established, the Steering Committee recommends that these same monitoring questions be used throughout the North Zone. They should be based on the assumptions made during the E-CAP and VDDT modeling processes which, if incorrect, would change the predicted outcomes or timeframes for achieving the desired outcomes. Notably, with respect to reducing departures from NRV in one or more of the forest's ecological systems. These monitoring questions should be measurable attributes related to expected outcomes. That would make it possible to obtain an objective evaluation of:

    1) the effectiveness of the implemented strategies for reducing departure from NRV in the ecological systems, and

    2) whether the assumptions made by the Steering Committee to set some model parameters were valid, despite some uncertainties.

- The LANDFIRE BpS models describe a reference condition that should be used when planning at the watershed or project level: however, reference stands should be used whenever they are available and applicable.
- When feasible, naturally-occurring small gaps (under two acres in size) in Cove Forests should be tracked, but not counted as early successional habitat.
- In order to ensure that each restoration project is successful, the CNF should include:
    - Clear goals and measureable objectives for achieving ecosystem structure and composition.

- Project level monitoring to measure whether, and to what extent, those objectives are achieved.
- Evaluation of the results, including consideration of whether and how this and future projects should be modified. To that end, flexibility should be built into each project at the planning stage so that the project can be modified as necessary.

Partnerships

Partnerships in land stewardship reflect a growing and important trend: the joining of passion and resources by committed citizens, organizations and government agencies to achieve social, economic and ecological goals.

The Forest Service has worked with partners throughout its 100-year history, but the challenges of land management have grown more complex and the needs of the public more varied. The American people today are voicing their strong desire to volunteer and participate in the stewardship of natural resources and in the decisions that affect their communities.

The words “partnership” and “partners” are used in a broad way to describe relationships between the people, organizations, agencies and communities that work together and share interests. The Forest Service regularly works in partnership with other entities, including tribes, states, federal agencies, nonprofits, businesses and communities.

However, it is important to understand that the word “partnership” also has a more precise meaning according to federal policy. It defines partnerships as “arrangements that are voluntary, mutually beneficial, and entered into for the purpose of mutually agreed upon objectives.”

The Forest Service also frequently works with partners through informal activities that may serve as springboards for formal arrangements later. For example, many agency employees participate in community networks to offer educational events and share skills and expertise with local landowners and citizens without a formal, documented arrangement. In practice, this broadens the meaning of partnership beyond the specific definition under federal policy and beyond formal arrangements.

The Forest Service is responding to land management challenges by empowering employees and partners to create and sustain successful partnerships. The Forest Service and the National Forest Foundation have produced a *Partnership Guide* as a tool to help Forest Service employees, experienced partners, and first-time or potential partners work together more effectively and efficiently. The guide answers common questions about the Agency's policies and procedures, helps partnerships anticipate potential hurdles, and provides contacts and other resources to help users find more specific guidance.

The *Partnership Guide* highlights creative approaches taking place across the country that promote sustainable and vibrant forests, grasslands and communities. Through partnerships like these, the Agency is learning how to more successfully sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

The *TN 2010 Forest Resource Assessment* provides a comprehensive analysis of the forest related condition, trends, threats and opportunities within the state. The CNF shares border with both state and private forests. When developing restoration projects, the USFS is encouraged to coordinate its efforts with state and private landowners to ensure mutual goals are achieved for conserving Tennessee’s unique system of forests.

Literature Cited

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APPENDIX A. RESULTS OF MODEL RUNS

APPENDIX B. MANAGEMENT STRATEGIES WORKBOOK

APPENDIX C. MAPS OF ECOLOGICAL SYSTEMS FOR THE CHEROKEE NATIONAL FOREST NORTH ZONE

APPENDIX D. S-CLASS DISTRIBUTION BY CURRENT RLRMP MANAGEMENT PRESCRIPTION

APPENDIX E. IMPLEMENTATION ANALYSIS

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APPENDIX I. DESCRIPTION OF THE ECOLOGICAL SYSTEMS VEGETATION CLASSES FOR THE CNF

APPENDIX J. BIOPHYSICAL SETTINGS IN THE NORTH ZONE OF THE CHEROKEE NATIONAL FOREST; REPORT FROM STEVE SIMON

APPENDIX K. CROSSWALK BETWEEN ECOLOGICAL ZONES AND BPS ECOLOGICAL SYSTEMS AND FS VEG FOREST TYPE