# Cherokee National Forest Landscape Restoration Initiative

Steering Committee Meeting Notes

Erwin Senior Adults Center, Tenn.

Thursday, October 28, 2010

4:00 -7:00 p.m.

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*Steering Committee Members Attending:* Katherine Medlock, The Nature Conservancy; Steve Novak, Wildlaw; Dwight King, Volunteer Logging Company/Sullivan County Commissioner; Catherine Murray, Cherokee Forest Voices; Danny Osborne, Tennessee Division of Forestry; Mark Shelley, Southern Appalachian Forest Coalition; Terry Porter, Tennessee Forestry Association; Geoff Call, U.S. Fish and Wildlife Service; and Karen Firehock, Facilitator.

*Members not attending:* Joe McGuiness, Cherokee National Forest; Parker Street, Ruffed Grouse Society; Dennis Daniel, National Wild Turkey Federation; John Gregory, Tennessee Wildlife Resources Agency; and Steve Henson, Southern Multiple Use Council.

*Guests Attending as Technical Experts:* Steve Simon; Dan Gibbs, Tennessee Wildlife Resources Agency (in person) and Greg Low (phone conference).

*Observers Attending:*

Joe Stelick, USFS Representative, Cherokee Forest Watauga District; Susan Shaw, USFS Representative; Mark Healey, USFS Representative; and Josh Kelly, WildLaw.

**Introductions:**

The meeting began with opening remarks from project facilitator Karen Firehock, followed by the introduction of the steering committee members, observers and an opportunity for observer comments. Josh Kelly from WildLaw asked that some other successional stages be considered for the model to allow for upper age limits beyond 80 - 100 years in order to more accurately reflect the true age distribution of the forest. He recommended consulting a report by Hugh Irwin and work by Runkle on disturbance ecology for better information about hardwood and pine types.

**General Committee Business:**

Members discussed the importance of attending meetings and whether all members were able to meet the commitment of attending most meetings (schedules permitting). One member had missed several of the recent meetings and may need to be contacted to discuss options. Members asked if the committee could make better use of technology since October had required a lot of meetings and long drives for some. The committee has also used conference calls as well, but other technologies such as web-based meetings would also allow for sharing slides and other visual resources. WebEx was suggested as a technology that could be used to allow more digital conferencing. Ms. Firehock noted that if the group met in a facility with internet, then some members could join by webcam. Ms. Medlock

offered to look into web conferencing options to replace the Nov. 8 meeting. She noted that Nov. 8 would be too soon to meet as it would not likely be possible to get answers from experts raised at this meeting within a one-week window. Members agreed to cancel the Nov. 8 meeting and schedule a web/conference call based meeting instead.

Ms. Medlock noted that it will soon be time to make a master schedule for 2011 meetings and members should expect to receive a scheduling poll to fill in within the next few weeks. Locations for future meetings were also discussed. Bass Pro Shops and the Tennessee Wildlife Resources Agency were suggested as possible options for future committee meeting locations.

**Public Workshop Debrief:**

Karen Firehock stated that the presentations at the public meetings were well received. She noted that the Forest Service used the database created for the project to mail the meeting announcement and Cherokee Forest fact sheet to property owners bordering the forest. They also received a postcard allowing them to opt out of future mailings. This mailing was likely responsible for the positive turnout at the community meetings. Ms. Firehock provided the following attendance tallies: 70 for Erwin, 41 for Del Rio, and 32 for Shady Valley. Katherine Medlock thanked the Forest Service staff for providing the opening remarks and project introduction at each of the meetings. She also thanked committee members for attending (some for more than one meeting).

Ms. Firehock suggested that it might be a good time to create a "frequently asked questions" document. She explained that the timing is now good time to create this type of document since the project has more visibility from the meetings and the facilitation team now has a fairly good sense of the types of questions that are asked "frequently." She provided an example as "Will the committee's plan replace the forest management plan already adopted?" She said the short answer to this question would be "No" followed by a one-to-two sentence explanation. She suggested that the questions document be about two pages in length. Committee members agreed this was a useful suggestion to create an FAQ document. Ms. Firehock will draft a document in the next two weeks and circulate it to the committee for review prior to posting to the project website.

**New USFS Liaison:**

Susan Shaw announced her departure from the Cherokee National Forest. She will be taking a new position as Palouse District Ranger in Idaho. The Committee thanked her for all her hard work to date and for helping to fund and form the CNFLRI. Replacing her will be Mark Healey, Fire and Vegetation Management Staff Officer for the Cherokee National Forest. Mr. Healey works out of the office in Cleveland, Tennessee and he will serve in the USFS liaison role, previously filled by Ms. Shaw. The group welcomed him to his new challenge and again thanked Susan for her many past efforts to support the work of the committee.

**Questionnaire Distribution:**

Ms. Firehock noted that the on-line questionnaire had been posted to the web. She suggested that the coordination team should also make paper copies available to those who did not have internet access. She noted that several people at the public meeting did not have a computer and she suspected this might be a common problem that could block interested people from filling out the questionnaire. She suggested that the team send postcards to those who attended the meeting asking if they would like to have a paper version. She also responded yes to a committee member's question concerning whether it

would be okay to send names of those colleagues who might need a paper version as well. All agreed that having a paper option would be a good idea. Ms. Firehock agreed to send a postcard mailing to those who attended the workshops reminding them to take the on-line questionnaire and providing a postcard for them to return if they needed to fill out a paper survey instead. She noted that it is preferable for questionnaires to be done on-line, as all paper questionnaires will need to be entered by staff and this will cost some time in project hours. She promised to get the mailing out during the week following the committee meeting and to extend the deadline to the end of November to allow mailings to be responded to in time to include participants' replies.

**Review of Landfire Models -- Issues Remaining from October 4 meeting:**

Katherine Medlock reviewed the status of the models from past meetings and a list of proposed changes. Sections below relate to Memo on Proposed Changes to Landfire Biophysical Setting Models. *(See Appendixes A, B, C. Sections below refer primarily to the listing provided in Appendix A).*

*Age Class Distribution:* No changes needed. Challenges remain concerning what to do with representing age classes older than 100 years. A question was asked about how fires are recorded. The Forest Service only records forests that cover 900 or more acres so there would be fires that are not in any database. One member suggested that the fire numbers for disturbance regime may need to be changed in the model for both Oak and Cove forests and possibly others as well.

*Splitting the Oak Models:* Too much of this type of forest is now in the mid-range. Steve Simon noted that this is "squeezing the bell shaped curve" distribution upwards since there is no significant disturbance that would be present if there were a normal fire regime. It was noted that it will not be adequate to simply adjust the age classes; it will also be necessary to consider changes to the disturbance factors. Greg Low noted that there may be too many trees now in the 70 to 100 year age class. One suggestion was to split the later age class from one to two or three classes to reflect that there may be many trees older than 100 years.

Henry McNab at Bent Creek and Peter Bates from the Fire Learning Network have been suggested to possibly help the committee with this issue. Mr. Bates could help with the Higher Elevation Red Oak Model. Steve Simon agreed to meet with Mr. Bates and Mr. McNab to describe his findings on the landscape. He noted that he had good information on the general pine and oak ecological systems but not so much on the high elevation red oak type; probably because there was not a great deal of high elevation landscape within the Cherokee. In the 600 plots he has conducted so far, he has found at least four types of oak ecological systems. He also noted that the oak dominated ridge tops having a rich cove understory (a fairly unique type he also found in Virginia) and have likely changed considerably since the decline of the chestnut 90 years ago.

The group agreed to have Ms. Medlock put together a panel of experts on disturbance in oak and hardwood forest types to help the committee answer some of these questions. Mr. McNab and Mr. Bates will be included in this panel. Others will be included as suggested by the Steering Committee.

One participant asked if Mr. Simon was using data from FIA plots. Forest Service staff responded that they cannot provide that data with locations. They could use the 2010 FIA data later on to compare it with Mr. Simon's findings as a way to assess accuracy. The USFS staff noted that since location data may be released a year after FIA data collection, they could provide the 2009 data.

*Riparian Model Description:* Mr. Simon noted that he is using a digital elevation model and this could be one way to approximate likely stream locations. He explained that, in terms of stream effects on riparian

vegetation, this is only a factor when stream gradient is low enough to be depositing sediment in the floodplain. These streams with established and extensive riparian vegetation tend to be at least 4th to 5th order streams or larger (higher orders). Smaller, step pool streams may not have much of an impact on the surrounding vegetation because streams have very limited floodplain on steeply sloped areas and this is typical for much of the Cherokee National Forest. Participants noted that they will need to consider needs for in-stream restoration at a later date. It was suggested that Jim Herrig and Marcia Carter, who is working in the north end of the Cherokee could help with this issue.

One committee member asked if the definition for riparian areas and allowed management practices would ever be changed. US Forest Service staff noted that harvest and management are allowed currently in riparian areas, as long as the additional conditions specified in the Forest Management Plan are met. Two participants noted that it is so difficult to get the necessary permission to harvest in these areas that they are essentially "closed" areas. USFS Staff responded that if the CNFLRI committee wanted to make recommendations to change the management requirements for riparian areas, this would likely carry a good deal of influence with the Forest Service due to the diversity of perspectives represented on the committee. This would require a change to the Forest Management Plan.

The committee agreed to allow Mr. Simon to map riparian areas (along streams at least 4$^{th}$ order in size ) according to the definition of riparian areas within the Biophysical Systems Model. If there are any changes that he sees as being necessary to the model, he will notify the committee.

*Cove Forests:* The committee discussed the addition of a sixth box and a change in the fire return interval as well as the disturbance regime. The specific changes needed could also be determined by the expert workshop to be held later in the month. It was also suggested to add Chris Ulrey and Craig Lorimer to this group. The group referred to a report produced by Hugh Irwin (Appendix B) that outlined some of the potential changes.

*Fire Return Interval:* Montane Pine was within the accepted range. The fire experts on the call with Katherine Medlock wanted to stress several factors to the Steering Committee including the scale of the fire, the timing of the fire, and the need for a diversity of conditions across the landscape. For example, a five-year return interval should not mean that every acre of that system should be burned every five years. The group should refer to previous e-mail reports sent by Ms. Medlock for the details of these suggestions. Ms. Medlock explained that in the Montane Pine Biophysical Settings Model, the diameter at base height (DBH) jumps from DBH five to the next class that starts with DBH nine, but that is not an error. The model calls for class sizes such as sapling, poles etc. The modelers had to choose which classification best fit each category, rather than showing the progression from one size to the next.

Ms. Medlock also noted that the VDDT model numbers for low elevation pine were missing some numbers and this is an error in the table that needs to be fixed. She also reminded the group that they are now creating a Cherokee Forest Version of the Landfire Model with help from the models' creators and the addition of new field data from Steve Simon. She reminded the group that this takes some time and she thanked everyone for their patience.

Steve Simon asked if there were any way to get numbers for smaller acreage fires because his observations so far indicated that they are extensive on the CNF and could provide considerable early successional habitat. It was suggested that he contact Eddie Sellers in the USFS who should have that information. Mr. Simon added that he could use satellite imagery to find likely burn sites and then use the USFS fire records to ground truth his conclusions, but he cautioned that this would be very time-consuming. One committee member also noted that there had been some significant pine forest loss

from pine beetle kills and this should also be noted when determining likely percentages of forest types in the Cherokee. FS Veg data (formerly referred to as CISC data) will be crosswalked to the successional class (s class). Staff in the Cherokee National Forest are currently working on this crosswalk. This crosswalk will be used to create our current conditions map.

**Next Steps**

2) Ms. Firehock will send out a mailing to public meeting attendees and stakeholders on the attendance lists inviting them to participate in the questionnaire. [Note: This was completed Nov. 5]

3) Ms. Firehock will draft a "frequently asked questions" document and send it to the committee for review.

3) Ms. Medlock will set up a workshop meeting for McNab, Simon and Bates to work on resolving issues with some of the forest types.

4) Committee members to participate in web ex type conference call within next two weeks to discuss findings from other data and model related questions. Ms. Medlock will schedule this meeting. [Note: this was completed Nov. 10]

5) A master meeting schedule poll will be sent to committee members in November to create the 2011 calendar. [Note: this was completed Nov. 16].

For more information or to suggest corrections to the minutes, contact karenfirehock@gmail.com

**Next Meeting:** TBD

**Appendixes:**

**Appendix A**: Memo on Proposed Changes to Landfire Biophysical Setting Models (list developed in response to questions raised at Oct. 4, 2010 meeting)

1) Age Class Distribution. There were a number of concerns raised at the Oct. 4th meeting about the age class distributions in the BpS models. I sent out an email with an explanation of how those numbers were determined and asked for any remaining concerns to be resubmitted (see email 10/13/2010). I haven't heard back from anyone and I am currently assuming that the explanation cleared up any concerns. Unless I hear from committee members prior to the meeting on the 28th, this will not be a topic for discussion.
2) Riparian Model Description. The committee had concerns about the description/definition of riparian areas and how they would be mapped. Steve Simon has offered his help resolving this concern and has developed four options for the committee to consider. Steve will be at the meeting on the 28th to help us work through this discussion. The four options are:
    a. Simply use the Landfire BpS for this type recognizing that it might not capture all of the actual riparian areas. These can be captured by buffering known streams.
    b. Have Steve refine / replace the Riparian BpS mapping but follow the Landfire concept for the type.
    c. Revise the language in the Landfire BpS model based upon the type of riparian areas that can be successfully modeled (i.e., with highest mapping accuracy).
    d. Describe Riparian areas as imbedded within coves / alluvial forests / and floodplains.
3) Splitting the Oak models. The committee expressed strong interest in splitting High Elevation Red Oak (HERO) out of the Southern Appalachian Montane Oak BpS and splitting the Southern Appalachian Oak Forest into a mesic and xeric model. Splitting these models will also allow the committee to look at any

other minor changes to the language or details found within the original Oak models (questions about landslides, concerns about language regarding fire return intervals, etc.). Greg Low and I have been looking in to the logistics of achieving these splits. Doing new VDDT model runs for these splits will take virtually no time. Jim Smith is ready to help us with that aspect of the process. It boils down to two considerations. First is the availability of experts to help us populate the model. I have reached out to Henry McNab at Bent Creek and plan to also contact Peter Bates from the FLN to possibly help us with this. Second is the time it will take to pull together those experts, write the descriptions, and agree on the details. I am hopeful that this could be completed within the current timeline the committee has agreed to, however, it may cause a delay depending on availability of the experts.

4) Cove Forests. There was concern that the Cove Forest BpS model did not include references from several available sources. The Southern Appalachian Forest Coalition (SAFC) agreed to research these sources and propose any suggested changes to the model based on that information. SAFC will send this information to the committee prior to the meeting on Oct. 28th.
5) Fire Return Intervals in Pine models. The committee raised a concern that the fire return intervals in both the Montane and Low-Elevation Pine BpS models should be double checked for accuracy based on the latest science. I have asked a group of fire researchers to attend a conference call to discuss this and make recommendations to the committee for any changes. This call is scheduled for Oct. 21st at 1:00. I will also ask this group (which includes the original author of the model) about the apparent discrepancy in the tree size class in the S.A. Montane Pine model.

**Appendix B**: Paper from Hugh Erwin

Addressing Limitations in LANDFIRE Modeling of Ecological Structure for Southern Appalachian Forests

Hugh Irwin 10/27/2010 (Revised)

I had previously written about limitations in data for an ECAP process in the northern Cherokee and more broadly in the Southern Appalachians. Assessing ecological departure in the LANDFIRE and ECAP process depends on assessment of both reference conditions and current conditions. Improved modeling of reference conditions for Southern Appalachian forests through an "ecological zone" modeling offers a more accurate model of reference conditions than the LANDFIRE model. However, this leaves the need for an accurate assessment of current conditions. LANDFIRE offers only rather low resolution data for current conditions and has very little accurate information on forest structure. I had suggested CISC/FSVeg data as a surrogate to use for forest age/forest structure as this is the most accurate current data that gets at this information on national forest lands, and it tend to be most accurate for more recent time periods (80 years and less). I support the use of CISC/FSVeg data in an ECAP process, but there are limitations in this data that would need to be addressed in order to conduct a meaningful analysis.

CISC data (and FSVeg data based on CISC) is fairly accurate for relatively recent management activities reflecting clearcuts and regeneration harvests since Forest Service acquisition. It is inaccurate in assessing ecological type and ages before acquisition. CISC forest types were originally determined based on timber purposes and focused on tree species of most value in timber management. There are cross walks from these timber forest types to ecological classifications, most notably the old growth forest types in the Region 8 old growth guidance[1]. These classifications could be usefully used for fairly large landscape approximations of departures from ecological types compared to ecological zones. Some departures will represent actual departures from ecological types. For example, most CISC types classified as white pine are either old field successions or planted plantations. In this case departures between reference conditions and current CISC conditions will represent a real ecological departure. In other cases CISC classification may have focused on timber species that may or may not reflect the

[1] USDA. 1997. Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region. Atlanta, GA: USDA Forest Service, Southern Region.

actual ecological type of the stand. In other cases the CISC type may indicate an ecological type that masks its departure from reference conditions. For example a tulip poplar stand from an old clearcut would fall within a "cove hardwood" ecological type in most crosswalks. However, the stand may be almost pure tulip poplar from past management as opposed to the rich diversity of tree and herbaceous species found in reference cove hardwood forest. In this case the lack of departure from a reference condition in the analysis would mask the actual departure of composition of the stand from reference cove hardwood. It is important that not too much reliance be put on these ecological type departures. Accurate assessment would require site assessment.

Departure of ecological type will also be informed by the age of the stands. Most Southern Appalachian ecological types are uneven aged or all aged forests. This is reflected in the biophysical settings descriptions but is inadequately accounted for in LANDFIRE and the biophysical settings. Many Southern Appalachian ecological types are only recovering their species diversity as they recover from past disturbances and age past the "mature age" in the biophysical settings descriptions. It appears that LANDFIRE is blind to the difference between forest that has reached its mature age and forest that has reached old growth conditions. There are both compositional and structural differences in these forests. As pointed out above, many old clearcuts that would be classified as "mature" are just starting to regain species that were outcompeted during early and mid successional stages. This is especially the case where species such as tulip poplar have dominated a stand after clearcuts. Other species favored more by gap phase dynamics as opposed to large clearings are just starting to be reestablished in these "mature" stands.

Structural characteristics also evolve after a stand reaches "maturity" as defined in the biophysical settings. Stands maturing from old clearcuts and regeneration harvests are primarily even aged stands as opposed to the all age stands characteristic of most Southern Appalachian forests. As opposed to the gap phase dynamics and small scale disturbance responsible for disturbances in reference forests, the large clearcuts of industrial forestry characteristic of turn of the 20$^{th}$ century logging are not typical disturbance patterns. The ongoing clearcuts that occurred under Forest Service management during the 20$^{th}$ century are also not typical of the natural disturbances in reference forest. These clearcuts, which in many cases consisted of dozens of acres were smaller than clearcuts of industrial logging but still larger than typical disturbances of reference forests. Occasional disturbances of this size would have occurred in reference forests, but as reflected in the biophysical setting descriptions, smaller gap phase and intermediate disturbances were more typical of reference forest. The "mature" age in the biophysical settings descriptions is insufficient to allow forest to regain the complex multi-age and multi-level structure of reference forest.

If there were the occasional large past disturbance from past management this could be equated to the occasional large natural disturbance. However, the devastating disturbance patterns at the turn of the 20$^{th}$ century and the ongoing atypical disturbance patterns maintained through much of the 20$^{th}$ century must be accounted for in determining current departure from reference conditions. The assessment of departure between reference conditions (as described in the biophysical settings) and current conditions (as assessed with CISC data) would indicate sufficient or overabundance of "mature" forest. However, this assessment would be incorrect in two respects.

First, this simplistic assessment ignores the differences across the spectrum of forest that could be categorized as "mature". Between forest that has reached the minimal mature age in the biophysical settings description and forest that has reached old growth conditions there are huge differences. There are major structural differences as the forest ages past early mature conditions and experiences disturbances and gaps that allow the development of a multi-level and multi-age structure. Compositional diversity also develops as trees that had little chance to develop in an even aged forest now are better competitors. Because of the history of logging in the region, there is an abundance of forest that has reached a mature stage as described in the biophysical settings, but very little that has fully recovered from this past management to reach old growth conditions. In the reference forests described in the biophysical settings, one would expect to have mature forest across this spectrum - from that just qualifying as mature all the way to old growth. It is an appropriate task of ecological restoration to provide for recovery across this spectrum - not just making sure there is sufficient "mature" forest of a minimal age.

Secondly, this simplistic assessment ignores the scale and landscape structure of forest in relationship to reference conditions. One could argue with the quantities of disturbance documented in the biophysical settings descriptions – one could argue that they are unrealistic in fire return intervals and the amount of major disturbances. However, aside from these details, the descriptions do reflect the fact that is well supported in the literature that natural disturbances were primarily gap phase dynamics and other smaller disturbances with the occasional and rare larger scale disturbance. As reflected in the biophysical descriptions, most Southern Appalachian forest types were uneven aged. This is in contrast to current even-aged conditions due to past management. An analysis of departure using CISC ages would tend to be blind to this structural departure because it would see "mature" forest as having recovered reference conditions when in reality this is far from the case. Even aged forest that has just reached the "mature" age in the biophysical settings descriptions is still for the most part even-aged forest that lacks the structural diversity typical of reference forest. And at a landscape scale this forest retains a blocky even-aged structure as a legacy of past management. Ecological restoration, if it is going to address the ecological goal of restoration to reference conditions must address this scale and landscape structure issue.

While LANDFIRE does not account for these issues directly, there is no real reason that the model cannot be adapted to reflect these ecological factors. Disturbance factors estimated in the biophysical settings give the factors necessary to model the pattern of disturbance across the landscape in a steady state reference condition, reflecting the scale of disturbance that should be expected under reference conditions. If LANDFIRE itself cannot handle this modeling it could be performed in LANDIS or other modeling frameworks. Considerable work has been done to document the conditions, age, and other characteristics of old growth forest (see Region 8 OG Guidance[2] and Tyrell et.al[3]. This information would provide the factors to model not just the simplistic reference conditions of "mature" forest but also the expected occurrence, distribution patterns, and scale of old growth forest and forest approaching old growth.

This issue of scale and landscape structure of forest disturbance is pertinent not only to old growth but is also relevant for early succession and mid succession forest. The pattern of forest structure has been disrupted over the last century or more through alterations of disturbance patterns. Early succession is currently in high demand because a number of species in decline have been correlated with early succession habitat. A critical analysis also reveals that true existing old growth is also in extremely short supply in the Southern Appalachians. Much of the existing forest is mid age. Although a significant amount of this forest is classifiable as "mature" under the LANDFIRE framework, this is misleading. If forest age on national forest lands is graphed against acreage, one gets a classic bell curve, with very little early succession and very little old growth or near old growth. Most of the forest is in the bell surrounding the middle of the graph. This is also the forest that provides the least structural diversity and the least habitat diversity. It is increasingly being suggested that logging should be increased to provide early succession habitat. However, if logging or other vegetation management is concentrated in the rare forest that is nearing old growth, it would act to perpetuate the exiting distortion in forest structure as well as perpetuate the unnatural even age pattern of forest across the landscape.

Natural disturbance provided a mix of habitat across evolutionary time. This occurred as a spectrum of disturbances ranging from gap phase through various sized disturbance to the rare large disturbance. These natural disturbances still operate (fire, ice, wind, tornado, hurricane, disease, natural mortality) and should be accounted for in forest planning and management. Ecological restoration as applied in the Southern Appalachians

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[2] USDA. 1997. *Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region*. Atlanta, GA: USDA Forest Service, Southern Region.

[3] Tyrrell, Lucy E.; Nowacki, Gregory J.; Buckley, David S.; Nauertz, Elizabeth A.; Niese, Jeffrey N.; Rollinger, Jeanette L.; Crow , Thomas S.; Zasada, John C. 1998. *Information about old growth for selected forest type groups in the eastern United States*. General Technical Report NC-197. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station

should seek to reestablish natural patterns of forest structure across the landscape that would have a natural range of variation. There is a very appropriate role for vegetation management in reestablishing reference conditions from the forests we have after over a century of exploitation for timber products. There is even a good rationale for creating early succession in the short term to provide a bridge of habitat for species that would otherwise be in jeopardy. However, this early succession habitat should not be created from forest that was least altered or has largely recovered and is regaining uneven age structure and species diversity. A large proportion of our forest is in a degraded condition with poor species diversity, shifted species composition, and a lack of structural diversity. Ecological restoration and vegetation management should be concentrated in these areas (under the swell of the bell curve and even in degraded areas on the left of the bell curve). To be a legitimate ecological restoration framework the structural and landscape pattern distortions discussed above have to be addressed.

Some specific suggestions for altering the Cove Hardwood biophysical setting description and model:

- The Class A Vegetation Class fails to mention gap phase dynamics as a disturbance responsible for early development in contrast to the predominance of gap phase dynamics. Runkle puts the proportion of canopy openings at 9.5% of land area (Runkle, 1982).
- The Class C Vegetation Class seems overestimated based on references below and references cited in the BpS. This "late stage open development" seems atypical of cove hardwood, especially in light of the BpS description that cove hardwood occurs on "…moist, topographically protected areas …". The BpS reference from NatureServe states that "this system is naturally stable, uneven-aged forests, with canopy dynamics dominated by gap phase regeneration on a fine scale. And this emphasis on fine scale disturbance is consistent with Runkle's studies. There is no citation in the BpS to justify this level of "Late development-open" Class. Runkle in discussing plots in a wide variety of coves focuses on gaps, not documenting significant occurrence of open structure, especially that would exceed gap dynamics. These "open overstory" conditions distinct from gaps probably occur occasionally but would be rare. It is recommended that Class C be dropped or set at a low level – less than 5%.
- The fire return intervals used in the BpS are not substantiated by any references and they seem too frequent based on the BpS references and references below, particularly for stand replacement fires. Under the BpS "Comment" section there is this admission: "This model is based on the model R8MMHW (Mixed Mesophytic Hardwood) from the Rapid Assessment phase; that one replaced model R7MMHW from the Northeast model zone. The VDDT model for R8MMHW was adopted in its entirety and used to represent this BpS." This discloses that this model is likely more representative of the Northeast than Southern cove hardwood and that little or no effort was made to adapt it to Southern Appalachian forests. The fire return interval for replacement fires should be longer than mixed severity fire. Buckner (1983) cites charcoal evidence of fire in coves, but the evidence that this charcoal was from stand replacement fires is weak, as is any evidence that stand replacement fire has occurred on cove sites (aside from anthropogenic occurrence associated with logging) with a frequency that can be accurately measured. These intervals should be more consistent with (and probably of longer intervals) than South-Central Interior Mesophytic Forest. Suggested fire intervals for Cove Hardwood model: for mixed intensity fires 738 years; Replacement fire interval of 1,000 years.
- As discussed in greater detail in the above discussion, the vegetation classes used in most of the BpS fail to adequately characterize most Southern Appalachian forests. This is particularly relevant to cove hardwood forest which is one of the most clearly all-aged forest characterized primarily by fine scaled gap phase dynamics. The classes used in this BpS are not only inadequate to characterize the ecological dynamics of this ecological type but actively distorts the actual ecological dynamics of reference conditions in this forest. Lumping a closed late development class into one 100+ class does not reflect the reality of the ecological structure that develops in these forests. Most of this forest type has been clearcut over the last 100+ years, but sufficient good examples remain that these ecological dynamics are well documented as illustrated in the references below. As discussed above, these forests will still have even aged structure 100 years after clearcutting and will only be beginning the process of regaining the all age structure and structural diversity of reference conditions. At the very least, additional classes should be added to represent structural development past this minimum "mature" age. Region 8 old growth

guidance for existing old growth in cove hardwood sets the criteria for "minimum age for the oldest existing age class" at 140 years along with additional criteria for DBH, basal area, and disturbance. This 100 – 140 year period of developing forest structure, as well as a 140+ class should be considered a bare minimum for classes to characterize this ecological type. Cove hardwood is characterized (in its reference conditions) by diverse forest structure (as well as very diverse tree and herbaceous species), fine scale gap phase processes, and the development and maintenance of old growth conditions. A more robust model that addresses the continuum of conditions for this forest (and others) in a more robust manner would be preferable, but these additional vegetation classes should be considered a bare minimum.

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