Monitoring Questions for Cherokee NF Landscape Restoration Initiative Management Strategies

The Cherokee National Forest (CNF) Revised Land and Resource Management Plan (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 recommendations of the Cherokee National Forest Landscape Restoration Initiative (CNFLRI) Steering Committee are intended to guide the implementation of ecological restoration efforts and are based on the Enhanced Conservation Action Planning (E-CAP) framework, which identifies the Natural Range of Variability (NRV) for ecological systems on the CNF, recommends management strategies, and uses the Vegetation Dynamics Development Tool (VDDT) model to estimate the degree to which departures from NRV would be reduced by applying the various management strategies to the forest's ecological systems. The questions that appear below under the heading "Implementation" provide suggestions for the United States Forest Service (USFS) to use in tracking implementation of the recommended management strategies.

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. The lists of questions that appear below under the heading "Effectiveness" were generated by reviewing Excel workbooks containing descriptions of management strategies and the committee's assumptions about the responses those strategies are expected to produce in the various ecological systems addressed by the CNFLRI, focusing on assumptions with a high degree of uncertainty. Most of these effectiveness monitoring questions are relevant to many, if not all, of the ecological systems and are therefore repeated in many of the sections that follow.

The recommendations for implementation that the Watershed team will be making in the Paint Creek watershed will provide some opportunities to use these monitoring questions. However, not all of the treatments will be used in Paint Creek, therefore, the team recommends that the other questions be used in other areas of the CNF at the first opportunity to implement that particular treatment.

Cove Forest

CF1 – Gap Harvest + Thinning

Management Action Description	From Class	To Class	Cost/ Acre	Model Notes	Management Comments
Harvest ranging from 2 to 40 acres in size, and thinning between gaps, to create gaps and more open forest	B- Mid-Closed (age 80-99)	C- Late Open (80%) and A (20%)	$60 (commercial); $250 (non-comm)		Typical harvest constitutes 1/5 to 1/3 of stand; repeated on different % in 10-30 years, depending upon monitoring. Less than 30 basal area for gaps; thinning is 40 and above

CF2 – Regeneration Harvest

Shelterwood harvest of majority of overstory	D- Late-Closed	A- Early	$50 (commercial); $150 (non-comm)		Typically 10-40 acres in size.

CF3 – Harvest-Restore + Plant

Restoration harvest with planting - remove entire overstory of uncharacteristic white pine; plant hardwood seedlings	WP- White Pine	A- Early	$210 (commercial); $310 (non-comm)	60% success rate	Assumes two years of follow-up herbicide treatments. Planting only @ $100/acre; w herb @ $160/acre. Dependent upon infrequent favorable market conditions to be commercially viable.

Implementation

Treatments	Is this information currently collected?	Recommendation

- What is the acreage thinned versus acreage subjected to gap harvests?

- What is the size distribution (range, mean, SD) of gaps created by harvest?

- What is the distribution of basal area (range, mean, SD) retained in gaps vs. thinned areas?

- Was the treatment commercial or non-commercial, and what was the cost/acre (implementation as defined by the ROI calculations done during the E-CAP process)? Were there attempts to bid any of these units as a commercial sale that were unsuccessful? If so, why?

- How much residual basal area is retained following shelterwood harvest?

- What species were planted and what were the stocking rates for each?

- Were any characteristic species present in canopy and, if so, what was the residual BA of these species retained during treatment?

- Were follow-up herbicide treatments applied? How many and in which years following treatment?
- Were there obstacles to implementing any of these treatments? If so, what were they and how can they be avoided?

CF1	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
CF1	Yes, could be determined from existing data collected	Recommend that this information be contained in monitoring reports and reviewed annually
CF1	Yes, could be determined from existing data collected	Recommend that this information be contained in monitoring reports and reviewed annually
CF1, CF2, CF3	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
CF2	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
CF3	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
CF3	Presence/absence information is currently available for each species, but, BA is collected for the stand (not for each species).	No change recommended. Please contain in annual reports
CF3	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
All	Not currently documented	Recommend that this information be contained in monitoring reports and reviewed annually

Effectiveness

- What percent of stand remains in the late open s-class 8-10 years after treatment?

- What percent of stand transitions to early s-class?

- Within areas transitioned to early s-class, is regeneration of following species evident within 3-year and again at the 8-10 year - timeframe, and in what proportions: American beech, tulip poplar, American basswood, ash, eastern hemlock, yellow buckeye, yellow birch, sweet birch, black cherry, northern red oak, white oak, red and sugar maple, cucumber tree, mountain magnolia, and white pine?

- Within rich cove sites, what is the percent cover, dominant species composition, and species richness of lower/herbaceous stratum before and after treatment at the 3 year and again at the 8-10 year timeframe (ensure that sampling is done at approximately the same time of year)?

- Is 60% or more of treated area regenerated to desired species composition?

- What invasive species are present before the treatment? What is their percent cover? What invasive species are present after the treatment? What is their cover?

Treatments	Is this information currently collected?	
CF1	No	Recommend that this information be collected during crop tree release work and contained in annual monitoring reports
CF1	Yes	
CF1, CF2, CF3	Yes at 3 years. 8-10 year timeframe is usually preparation for crop tree release work so no species information collected.	Recommend that this information be collected during crop tree release work and contained in annual monitoring reports
CF1, CF2, CF3	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
CF3	Yes at the 3 year timeframe.	Recommend that this information also be collected at the 8-10 year timeframe and contained in annual monitoring reports
CF1, CF2, CF3	Yes. Botanical surveys done before treatment classify as abundant, occasional or uncommon. Presence/absence is documented 3 years post-treatment.	Recommend that this information also be collected at the 8-10 year timeframe and contained in monitoring reports and reviewed annually

Dry Oak

DO1 – Rx Fire

Management Action Description	From Class	To Class	Cost/ Acre	Model Notes	Management Comments
Prescribed fire to increase and maintain open classes	All classes but A	Open and A- Early	$50	In Closed classes 33% converts to Open, 8% converts to A, and 59% remains Closed; in Open classes 3% to A and 97% stays Open; A remains A	Assumes ~1000 block burn including mosaic of systems. Actual outcomes variable; depends upon prescription and if precription goals are met

DO2 – Rx Fire-Maintenance

Prescribed fire to maintain open classes	All Open (C,D,F)	Remains in class	$50		Used x years after other manangement treatments to maintain open classes

DO3 – Regeneration Harvest

Shelterwood harvest of majority of overstory	E- Late-Closed	A- Early	$50 (commercial); $150 (non-comm)		Typically 20-40 acres in size. Assumes continued fire.

DO4 – Woodland Restoration

Partial harvest/heavy thinning to create more open oak woodland	E- Late-Closed	D- Late Open	$50 (commercial); $150 (non-comm) - assume 50-50 ratio	80% success	needs fire to maintain

DO5 – Rx Fire WP/YP

Prescribed burns to restore oak woodland in Uncharacteristic White Pine and Yellow Polar where partial oak seed source present	WP- White Pine, YP- Yellow Poplar	D- Late Open	$ 50	80% success	

D06 – Harvest-Restore-Oak Overstory

Restoration harvest - remove partial overstory of uncharacteristic white pine, yellow poplar or yellow pine stands; no "oak planting"; leave some mature oak overstory	WP- White Pine, YP- Yellow Poplar, PD- Pine Dominated	C-Mid Open, D- Late Open	$50 (commercial); $150 (non-comm)	80% success rate when oak trees left	Success rate dependent upon continued fire. Simon estimates ~40% of the U-classes are in this category.

DO7 – Harvest-Restore+Plant

Restoration harvest with planting - remove entire overstory of uncharacteristic white pine, yellow poplar or yellow pine stands; plant oak seedlings	WP- White Pine, YP- Yellow Poplar, PD- Pine Dominated	A- Early	$210 (commercial); $310 (non-comm)	60% success rate	Assumes two years of follow-up herbicide treatments. Planting only @ $100/acre; w herb @ $160/acre. Success rate dependent upon continued fire

Implementation	Treatments	Is this information currently collected?	Recommendation
• What was the annual acreage burned in this ecological system and how much of this ecological system is currently contained within burn units??	DO1, DO2, DO3, DO4, DO5, DO6, DO7	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• What was the distribution among s-classes of the acres burned in this ecological system?	DO1, DO2, DO3, DO4, DO5, DO6, DO7	Information can be obtained from current information. However, fire staff will need GIS support to make it available.	Recommend that this information be contained in monitoring reports and reviewed annually
• How many previous Rx fires or wildlfires, if any, have occurred in each burn unit and what are the average and maximum fire return intervals for the site, if known?	DO1, DO2, DO3, DO4, DO5, DO6, DO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Is advance regeneration of desired species present prior to harvest – for treatments designed to effect transition to early s-class?	DO1, DO3, DO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Was the treatment commercial or non-commercial, and what was the cost/acre (implementation as defined by the ROI calculations done during the E-CAP process)? Were there attempts to bid any of these units as a commercial sale that were unsuccessful? If so, why?	DO3, DO4, DO6, DO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• In order to determine if the abundance of seed source had any effect on the outcome, please describe how abundant was the seed source in the stand prior to treatment?	DO5, DO6, DO7	Post fire there are seedling counts. Stand exam data prior to harvest tells us species present. May be able to extrapolate this information.	Please attempt to extrapolate this information and include it in the monitoring reports

- What species were planted and what were the stocking rates for each?

- Were follow-up herbicide treatments applied? How many and in which years following treatment?

- Were there obstacles to implementing any of these treatments? If so, what were they and how can they be avoided?

Effectiveness

- For individual Rx fires, record data related to fire behavior/effects – e.g., flame height, scorch height, percent consumption of leaf litter, etc. – in order to correlate stand level effects with fire intensity and evaluate whether prescription was achieved.

- What proportion of closed s-classes transition to open and/or early s-classes following Rx fire?

- What proportion of open s-classes transition to early s-class following Rx fire?

- What proportion of closed and open s-classes remain in those s-classes following Rx fire?

- In areas transitioned to early s-class, is regeneration of the following species evident within 3 year and again at the 8-10 year timeframe, and in what proportions: white oak, southern red oak, chestnut oak, scarlet oak, blackjack oak, red maple, pignut hickory, mockernut

DO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
DO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
All	Not currently documented	Recommend that this information be contained in monitoring reports and reviewed annually
Treatments	Is this information currently collected?	
DO1, DO2, DO3, DO4, DO5, DO6, DO7	Not done for every fire. Monitoring plots currently set in 4 types. Dry mesic oak, dry mesic oak/pine, Xeric pine/pine oak, Xeric oak.	Recommend pilot analysis of current information collected on the Cherokee since monitoring began to determine if information collected is adequate.
DO1, DO5	Not collected unless it was planned at a site specific scale.	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
DO1	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
DO1	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
DO1, DO3	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring.	No recommended change. Please contain in annual reports

hickory, white pine, tulip poplar,   (This list includes both fire tolerant and intolerant species in order to assess whether fire frequency/intensity is producing desired response.)

- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following Rx fire at the 3 year and again at the 8-10 year timeframe?
- What proportions of the lower/herbaceous stratum consist of regenerating trees and woody shrubs vs. forbs and grasses 3 years and again 8-10 years after treatment?

- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following silvicultural treatment at the 3 year and again at the 8-10 year timeframe and how does this condition vary within treated stands? (i.e., assess percent effectiveness of treatment within stand)
- What invasive species are present before the treatment? What is their percent cover? What invasive species are present after the treatment? What is their cover?

DO1, DO2, DO5, , DO7	Fire monitoring plots (described above) collect species, and dbh information at 2 and 5 year timeframe.	No recommended change. Please contain in annual reports
DO2, DO3, DO7	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
DO3, DO4, , DO6	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment. Basal Area and Canopy Cover information is collected prior to treatment. Not generally needed after treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
All	Yes. Botanical surveys done before treatment classify as abundant, occasional or uncommon. Presence/absence is documented 3 years post-treatment.	Recommend that this information also be collected at the 8-10 year timeframe and contained in monitoring reports and reviewed annually

Dry-Mesic Oak

DM1 – Rx Fire

Management Action Description	From Class	To Class	Cost/ Acre	Model Notes	Management Comments
Prescribed fire to increase and maintain open classes	All classes but A	Open and A- Early	$50	In Closed classes 33% converts to Open, 8% converts to A, and 59% remains Closed; in Open classes 3% to A and 97% stays Open; A remains A	Assumes ~1000 block burn including mosaic of systems. Actual outcomes variable; depends upon prescription and if precription goals are met

DM2 – Rx Fire-Maintenance

Prescribed fire to maintain open classes	All Open (C,D,F)	Remains in class	$50		Used x years after other manangement treatments to maintain open classes

DM3 – Thinning

Commercial or non-commercial mechanical thinning to create gaps and more open forest (remove ~20% of BA)	E- Late-Closed	D- Late Open	$50 (commercial)$150 (non-comm)		Needs continued fire to maintain at D. This is 'low-hanging fruit' and gets lower the closer it is to roads and on slopes < 30% slope (tractor logging); commercial requires at least 2500 board feet

DM4 – Regeneration Harvest

Shelterwood harvest of majority of overstory, following pre-harvest guidelines from "Loftis publications"	E- Late-Closed	A- Early	$50 (commercial)$150 (non-comm)		Vaible for medium to large loggers. Typically 10-40 acres in size. Assumes continued fire.

DM5 – Harvest-Restore-Oak Overstory

Restoration harvest - remove partial overstory of uncharacteristic white pine or yellow pine stands; no "oak planting"; leave some mature oak overstory	WP- White Pine, PD- Pine Dominated	C-Mid Open, D- Late Open	$50 (commercial); $150 (non-comm)	80% success rate when oak trees left	Success rate dependent upon continued fire. Simon estimates less than 25% of the U-classes are in this category.

DM6 – Harvest-Restore + Plant

Restoration harvest with planting - remove entire overstory of uncharacteristic white pine or yellow pine stands; plant oak seedlings	WP- White Pine, PD- Pine Dominated	A- Early	$210 (commercial); $310 (non-comm)	60% success rate	Assumes two years of follow-up herbicide treatments. Planting only @ $100/acre; w herb @ $160/acre. Success rate dependent upon continued fire

Implementation	Treatments	Is this information currently collected?	Recommendation
What was the annual acreage burned in this ecological system and how much of this ecological system is currently contained within burn units??	DM1, DM2, DM3, DM4, DM5, DM6	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
What was the distribution among s-classes of the acres burned in this ecological system?	DM1, DM2, DM3, DM4, DM5, DM6	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
How many previous Rx fires or wildfires, if any, have occurred in each burn unit and what are the average and maximum fire return intervals for the site, if known?	DM1, DM2, DM3, DM4, DM5, DM6	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
Was the treatment commercial or non-commercial, and what was the cost/acre (implementation as defined by the ROI calculations done during the E-CAP process)? Were there attempts to bid any of these units as a commercial sale that were unsuccessful? If so, why?	DM3, DM4, DM5, DM6	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
Is advance regeneration of desired species present prior to harvest – for treatments designed to effect transition to early s-class?	DM1, DM4, DM6	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
What species were planted and what were the stocking rates for each?	DM6	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
Were follow-up herbicide treatments applied? How many and in which years following treatment?	DM6	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
Were there obstacles to implementing any of these treatments? If so, what were they and how can they be avoided?	All	Not currently documented	Recommend that this information be contained in monitoring reports

Effectiveness

- For individual Rx fires, record data related to fire behavior/effects – e.g., flame height, scorch height, percent consumption of leaf litter, etc. – in order to correlate stand level effects with fire intensity and evaluate whether prescription was achieved.

- What proportion of closed s-classes transition to open and/or early s-classes following Rx fire?

- What proportion of open s-classes transition to early s-class following Rx fire?

- What proportion of closed and open s-classes remain in those s-classes following Rx fire?

- In areas transitioned to early s-class, is regeneration of the following species evident within 3 year timeframe and again at the 8-10 year timeframe, and in what proportions: white oak, northern red oak, chestnut oak, scarlet oak, black oak, red maple, hickory species, white pine, tulip poplar,   (This list includes both fire tolerant and intolerant species in order to assess whether fire frequency/intensity is producing desired response.)

- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following Rx fire 3 years and again 8-10 years after treatment?

Treatments	Is this information currently collected?	and reviewed annually
DM1, DM2	Not done for every fire. Monitoring plots currently set in 4 types. Dry mesic oak, dry mesic oak/pine, Xeric pine/pine oak, Xeric oak.	Recommend pilot analysis of current information collected on the Cherokee since monitoring began to determine if information collected is adequate.
DM1	Not collected unless it was planned at a site specific scale.	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
DM1	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
DM1, DM2	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
DM1, DM4, DM6	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring.	No recommended change. Please contain in annual reports
DM1, DM2, DM3, DM4, DM5, DM6	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring. Some stand level ocular estimates taken as well.	No recommended change. Please contain in annual reports

• What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following silvicultural treatment at the 3 year and again at the 8-10 year timeframe and how does this condition vary within treated stands? (i.e., assess percent effectiveness of treatment within stand)	DM3, DM4, DM5, DM6		Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment. Basal Area and Canopy Cover information is collected prior to treatment. Not generally needed after treatment.		Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
• What invasive species are present before the treatment? What is their percent cover? What invasive species are present after the treatment? What is their cover?	All		Yes. Botanical surveys done before treatment classify as abundant, occasional or uncommon. Presence/absence is documented 3 years post-treatment.		Recommend that this information also be collected at the 8-10 year timeframe and contained in monitoring reports and reviewed annually

Low Elevation Pine

LP1 – Rx Fire

Management Action Description	From Class	To Class	Cost/ Acre	Model Notes	Management Comments
Prescribed fire to increase open & early succesion classes	All classes but A	Open and A- Early	$50	In Closed classes 20% to open and 80% to A; in Open classes 10% to A and 90% stays Open; A remains A	80% conversion to A based on current conditions with beetles; wuld be lower in future. Assumes ~1000 block burn including mosaic of systems. Actual outcomes variable; depends upon prescription and if precription goals are met

LP2 – Rx Fire-Maintenance

Prescribed fire to maintain open classes	All Open (C,D)	Remains in class	$50		Used x years after other manangement treatments to maintain open classes

LP3 – Thinning

Thinning of late-closed class to create more open canopy	E- Late Closed	Late-Open	$600		Non commerical.

LP4 – Restoration Treatment + Planting

Eradicate uncharacteristic oak stands with pine re-planting	OD- Oak Dominated	A- Early	$300	85% success rate	Non-commerical. Success rate dependent upon continued fire

LP5 – Woodland Restoration (50% seed source)

Harvest commercial hardwood and allow pine regeneration	OD- Oak Dominated	D-Late Open		$50	80% success	Dependent on having a seed source

LP6 – Firebreaks

Clear 3 to 20 foot fire line and plant with native seed (grass) in urban interface area	All	A	$1,200		Cost is average $3000 per mile including seed, includes greater cost for areas with slopes and requirement for wider breaks. Figuring 2.5 acres per mile

Implementation	Treatments	Is this information currently collected?	Recommendation
• What was the annual acreage burned in this ecological system and how much of this ecological system is currently contained within burn units?	LP1, LP2, LP3, LP4, LP5	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• What was the distribution among s-classes of the acres burned in this ecological system?	LP1, LP2, LP3, LP4, LP5	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• How many previous Rx fires or wildlfires, if any, have occurred in each burn unit and what are the average and maximum fire return intervals for the site, if known?	LP1, LP2, LP3, LP4, LP5	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Is advance regeneration of desired species present prior to harvest – for treatments designed to effect transition to early s-class?	LP1, LP4	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Was the treatment commercial or non-commercial, and what was the cost/acre (implementation as defined by the ROI calculations done during the E-CAP process)? Were there attempts to bid any of these units as a commercial sale that were unsuccessful? If so, why?	LP3, LP4, LP5	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• What species were planted and what were the stocking rates for each?	LP4	Yes	Recommend that this information be contained in monitoring reports and reviewed annually

- In order to determine if the abundance of seed source had any effect on the outcome, please describe how abundant was the seed source in the stand prior to treatment?

- How many acres/year of firebreaks are created and planted to native species, and what is the cost/acre of this treatment?

- Were there obstacles to implementing any of these treatments? If so, what were they and how can they be avoided?

Effectiveness

- For individual Rx fires, record data related to fire behavior/effects – e.g., flame height, scorch height, percent consumption of leaf litter, etc. – in order to correlate stand level effects with fire intensity and evaluate whether prescription was achieved.

- What proportion of closed s-classes transition to open and/or early s-classes following Rx fire?

- What proportion of open s-classes transition to early s-class following Rx fire?

- What proportion of closed and open s-classes remain in those s-classes following Rx fire?

- In areas transitioned to early s-class, is regeneration of the following species evident within 3 year and again at the 8-10 year timeframe, and in what proportions: shortleaf pine, Virginia pine, pitch pine, Table

LP5	Post fire there are seedling counts. Stand exam data prior to harvest tells us species present. May be able to extrapolate this information.	Please attempt to extrapolate this information and include it in the monitoring reports
LP6	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
All	Not currently documented	Recommend that this information be contained in monitoring reports and reviewed annually
Treatments	Is this information currently collected?	
LP1, LP2, LP3, LP4, LP5	Not done for every fire. Monitoring plots currently set in 4 types. Dry mesic oak, dry mesic oak/pine, Xeric pine/pine oak, Xeric oak.	Recommend pilot analysis of current information collected on the Cherokee since monitoring began to determine if information collected is adequate.
LP1	Not collected unless it was planned at a site specific scale.	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
LP1	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
LP1, LP2	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
LP1, LP4	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring.	No recommended change. Please contain in annual reports

Mountain pine, southern red oak, chestnut oak, scarlet oak, other hardwoods?

- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following Rx fire at the 3 and again at the 8-10 year timeframe?

- What proportions of the lower/herbaceous stratum consist of regenerating trees and woody shrubs vs. forbs and grasses 3 years and again at 8-10 years after treatment?

- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following silvicultural treatment at the 3 year and again at the 8-10 year timeframe and how does this condition vary within treated stands? (i.e., assess percent effectiveness of treatment within stand)

- What invasive species are present before the treatment? What is their percent cover? What invasive species are present after the treatment? What is their cover?

LP1, LP2, LP3, LP4, LP5	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring. Some stand level ocular estimates taken as well.	No recommended change. Please contain in annual reports
LP1, LP4	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
LP3, LP4, LP5	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment. Basal Area and Canopy Cover information is collected prior to treatment. Not generally needed after treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
All	Yes. Botanical surveys done before treatment classify as abundant, occasional or uncommon. Presence/absence is documented 3 years post-treatment.	Recommend that this information also be collected at the 8-10 year timeframe and contained in monitoring reports and reviewed annually

Montane Pine

MP1 – Rx Fire

Management Action Description	From Class	To Class	Cost/ Acre	Model Notes	Management Comments
Prescribed fire to increase open & early succesion classes	All classes but A	Open and A- Early	$50	In Mid-Closed 20% to open and 80% to A; in Late-Closed 80% to Open and 20% to A; in Open classes 10% to A and 90% stays Open; A remains A	80% conversion to A based on current conditions with beetles; may be lower in future. Assumes ~1000 block burn including mosaic of systems. Actual outcomes variable; depends upon prescription and if precription goals are met

MP2 – Rx Fire Maintenance

Prescribed fire to maintain open classes	All Open (C,D)	Remains in class	$50		Used x years after other manangement treatments to maintain open classes

MP3 – Rx Fire – Oak (30% seed source)

Prescribed burns where partial pine seed source present	OD- Oak Dominated	A- Early	$50	80% success rate	Non-commercial - targeted to areas with seed source; estimated 30% of OD has seed source.

MP4 – Thin B-class to C

Thin mid-closed class to create more open canopy	B- Mid Closed	C- Mid Open	$90		

MP5 – Thinning

Thinning of late-closed class to create more open canopy	E- Late Closed	D- Late Open	$600		Non commerical.

MP6 – Restoration Treatment w/seed source

Eradicate uncharacteristic oak stands without re-planting; pine seed source present	OD- Oak Dominated	A- Early	$200	80% success rate	Non-commercial. Management treatment would be targeted to areas with seed source; estimated 30% of OD has seed source. Success rate dependent upon continued fire

MP7 – Restoration Treatment + Planting

Eradicate uncharacteristic oak stands with pine re-planting	OD- Oak Dominated	A- Early	$300	85% success rate	Non-commerical. Success rate dependent upon continued fire

Implementation

Treatments	Is this information currently collected?	Recommendation

Questions	Units	Information Available	Recommendation
• What was the annual acreage burned in this ecological system and how much of this ecological system is currently contained within burn units?	MP1, MP2, MP3, MP4, MP5, MP6, MP7	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• What was the distribution among s-classes of the acres burned in this ecological system?	MP1, MP2, MP3, MP4, MP5, MP6, MP7	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• How many previous Rx fires or wildlfires, if any, have occurred in each burn unit and what are the average and maximum fire return intervals for the site, if known?	MP1, MP2, MP3, MP4, MP5, MP6, MP7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Is advance regeneration of desired species present prior to harvest – for treatments designed to effect transition to early s-class?	MP1, MP3, MP6, MP7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Was the treatment commercial or non-commercial, and what was the cost/acre (implementation as defined by the ROI calculations done during the E-CAP process)? Were there attempts to bid any of these units as a commercial sate that were unsuccessful? If so, why?	MP4, MP5, MP6, MP7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• What species were planted and what were the stocking rates for each?	MP7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• In order to determine if the abundance of seed source had any effect on the outcome, please describe how abundant was the seed source in the stand prior to treatment? • Were there obstacles to implementing any of these treatments? If so, what were they and how can they be avoided?	MP3, MP6, MP7	Post fire there are seedling counts. Stand exam data prior to harvest tells us species present. May be able to extrapolate this information.	Please attempt to extrapolate this information and include it in the monitoring reports
	All	Not currently documented	Recommend that this information be contained in monitoring reports and

			reviewed annually
Effectiveness	Treatments		
• For individual Rx fires, record data related to fire behavior/effects – e.g., flame height, scorch height, percent consumption of leaf litter, etc. – in order to correlate stand level effects with fire intensity and evaluate whether prescription was achieved.	MP1, MP2, MP3, MP4, MP5, MP6, MP7	Not done for every fire. Monitoring plots currently set in 4 types. Dry mesic oak, dry mesic oak/pine, Xeric pine/pine oak, Xeric oak.	Recommend pilot analysis of current information collected on the Cherokee since monitoring began to determine if information collected is adequate.
• What proportion of closed s-classes transition to open and/or early s-classes following Rx fire?	MP1, MP3	Not collected unless it was planned at a site specific scale.	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
• What proportion of open s-classes transition to early s-class following Rx fire?	MP1, MP3	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
• What proportion of closed and open s-classes remain in those s-classes following Rx fire?	MP1, MP2	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
• In areas transitioned to early s-class, is regeneration of the following species evident within 3 year and again at the 8-10-year timeframe, and in what proportions: Table Mountain pine, Virginia pine, pitch pine, chestnut oak, scarlet oak, other hardwoods ?	MP1, MP3, MP6, MP7	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring.	No recommended change. Please contain in annual reports
• What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following Rx	MP1, MP2, MP3	Fire monitoring plots (described above) collect this information	No recommended change. Please contain in

fire at the 3 year and again at the 8-10 year timeframe?

- What proportions of the lower/herbaceous stratum consist of regenerating trees and woody shrubs vs. forbs and grasses 3 years and again 8-10 years after treatment?

- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following silvicultural treatment at the 3 year and again at the 8-10 year timeframe and how does this condition vary within treated stands? (i.e., assess percent effectiveness of treatment within stand)

- What invasive species are present before the treatment? What is their percent cover? What invasive species are present after the treatment at the 3 year and again at the 8-10 year timeframe? What is their cover?

	Pre, post, 1-2-5 year monitoring. Some stand level ocular estimates taken as well.	annual reports
MP1, MP3, MP6, MP7	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
MP4, MP5, MP6, MP7	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment. Basal Area and Canopy Cover information is collected prior to treatment. Not generally needed after treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
All	Yes. Botanical surveys done before treatment classify as abundant, occasional or uncommon. Presence/absence is documented 3 years post-treatment.	Recommend that this information also be collected at the 8-10 year timeframe and contained in monitoring reports and reviewed annually

Montane Red-Chestnut Oak

MO1 – Rx Fire

Management Action Description	From Class	To Class	Cost/ Acre	Model Notes	Management Comments
Prescribed fire to increase and maintain open classes	All classes but A	Open and A- Early	$50	In Closed classes 33% converts to Open, 8% converts to A, and 59% remains Closed; in Open classes 3% to A and 97% stays Open; A remains A	Assumes ~1000 block burn including mosaic of systems. Actual outcomes variable; depends upon prescription and if precription goals are met

MO2 – Rx Fire-Maintenance

Prescribed fire to maintain open classes	All Open (C,D,F)	Remains in class	$50		Used x years after other manangement treatments to maintain open classes

MO3 – Thinning

Commercial or non-commercial mechanical thinning to create gaps and more open forest (remove ~20% of BA)	E- Late Closed and B- Mid Closed	D- Late Open and C- Mid Open	$50 (commercial); $150 (non-comm)	Thinning in Class B suitable for older age stands, so applied to 25% of this class	Needs continued fire to maintain open. This is 'low-hanging fruit' and gets lower the closer it is to roads and on slopes < 30% slope (tractor logging); commercial requires at least 2500 board feet

MO4 – Gap Harvest + Thinning

Group selection harvest <1 to 2 acres in size and thinning between gaps, to create gaps and more open forest	E- Late-Closed	D- Late Open	$60 (commercial); $250 (non-comm)		Only viable for small loggers. Typical harvest constitutes 1/5 to 1/3 of stand; repeated on different % in 10-30 years, depending upon monitoring. These conditions assume fire at the suggested intervals from the BpS models.

MO5 – Regeneration Harvest

Shelterwood harvest of majority of overstory, following pre-harvest guidelines from "Loftis publications"	E- Late-Closed	A- Early	$50 (commercial); $150 (non-comm)		Vaible for medium to large loggers. Typically 10-40 acres in size. Assumes continued fire.

MO6 – Harvest-Restore-Oak Overstory

Restoration harvest - remove partial overstory of uncharacteristic white pine, yellow poplar or yellow pine stands; no "oak planting"; leave some mature oak overstory	WP- White Pine, YP- Yellow Poplar, PD- Pine Dominated	C-Mid Open, D- Late Open	$50 (commercial); $150 (non-comm)	80% success rate when oak trees left	Success rate dependent upon continued fire. Simon estimates less than 25% of the U-classes are in this category.

MO7 – Harvest-Restore + Plant

Restoration harvest with planting - remove entire overstory of uncharacteristic white pine, yellow poplar or yellow pine stands; plant oak seedlings	WP- White Pine, YP- Yellow Poplar, PD- Pine Dominated	A- Early	$210 (commercial); $310 (non-comm)	60% success rate	Assumes two years of follow-up herbicide treatments. Planting only @ $100/acre; w herb @ $160/acre. Success rate dependent upon continued fire

Implementation

Implementation	Treatments	Is this information Currently Collected?	Recommendation
• What was the annual acreage burned in this ecological system and how much of this ecological system is currently contained within burn units?	MO1, MO2, MO3, MO4, MO5, MO6, MO7	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• What was the distribution among s-classes of the acres burned in this ecological system?	MO1, MO2, MO3, MO4, MO5, MO6, MO7	Information can be obtained from current information. However, fire staff will need GIS support to make this available.	Recommend that this information be contained in monitoring reports and reviewed annually
• How many previous Rx fires or wildlfires, if any, have occurred in each burn unit and what are the average and maximum fire return intervals for the site, if known?	MO1, MO2, MO3, MO4, MO5, MO6, MO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Is advance regeneration of desired species present prior to harvest – for treatments designed to effect transition to early s-class?	MO1, MO5, MO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
• Was the treatment commercial or non-commercial, and what was the cost/acre (implementation as defined by the ROI calculations done during the E-CAP process)? Were there attempts to bid any of these units as a commercial sale that were	MO3, MO4, MO5, MO6, MO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually

unsuccessful? If so, why?

- What species were planted and what were the stocking rates for each?

- Were follow-up herbicide treatments applied? How many and in which years following treatment?

- Were there obstacles to implementing any of these treatments? If so, what were they and how can they be avoided?

Effectiveness

- For individual Rx fires, record data related to fire behavior/effects – e.g., flame height, scorch height, percent consumption of leaf litter, etc. – in order to correlate stand level effects with fire intensity and evaluate whether prescription was achieved.

- What proportion of closed s-classes transition to open and/or early s-classes following Rx fire?

- What proportion of open s-classes transition to early s-class following Rx fire?

- What proportion of closed and open s-classes remain in those s-classes following Rx fire?

MO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
MO7	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
All	Not currently documented	Recommend that this information be contained in monitoring reports and reviewed annually
MO1, MO2, MO3, MO4, MO5, MO6, MO7	Not done for every fire. Monitoring plots currently set in 4 types. Dry mesic oak, dry mesic oak/pine, Xeric pine/pine oak, Xeric oak.	Recommend pilot analysis of current information collected on the Cherokee since monitoring began to determine if information collected is adequate.
MO1	Not collected unless it was planned at a site specific scale.	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
MO1	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.
MO1, MO2	No	Recommend that this information be collected via remote sensing, analyzed, and contained in annual monitoring reports.

- In areas transitioned to early s-class, is regeneration of the following species evident within 3 year and again at the 8-10 year timeframe, and in what proportions: northern red oak, chestnut oak, white oak, cucumber tree, mountain magnolia, white pine, tulip poplar, red maple? (This list includes both fire tolerant and intolerant species in order to assess whether fire frequency/intensity is producing desired response.)
- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following Rx fire 3 years and again 8-10 years after treatment?
- What is the species composition, percent cover, and basal area in the upper and middle strata of the stand before and following silvicultural treatment at the 3 year and again at the 8-10 year timeframe and how does this condition vary within treated stands? (i.e., assess percent effectiveness of treatment within stand)
- What is the acreage thinned versus acreage subjected to gap harvests?
- What is the size distribution (range, mean, SD) of gaps created by harvest?
- What is the distribution of basal area (range, mean, SD) retained in gaps vs. thinned areas?
- What invasive species are present before the treatment? What is their percent cover? What invasive species are present after the treatment? What is their cover?

MO1, MO5, MO7	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring.	No recommended change. Please contain in annual reports
MO1, MO2, MO3, MO4, MO5, MO6, MO7	Fire monitoring plots (described above) collect this information Pre, post, 1-2-5 year monitoring. Some stand level ocular estimates taken as well.	No recommended change. Please contain in annual reports
MO3, MO4, MO5, MO6, MO7	Botanical surveys done before treatment classify as abundant, occasional or uncommon. Not collected post treatment. Basal Area and Canopy Cover information is collected prior to treatment. Not generally needed after treatment.	Recommend establishing plots to determine species composition, percent cover, and basal area before treatment and 8-10 year timeframe.
MO4	Yes	Recommend that this information be contained in monitoring reports and reviewed annually
MO4	Yes, could be determined from existing data collected	Recommend that this information be contained in monitoring reports and reviewed annually
MO4	Yes, could be determined from existing data collected	Recommend that this information be contained in monitoring reports and reviewed annually
All	Yes. Botanical surveys done before treatment classify as abundant, occasional or uncommon. Presence/absence is documented 3 years post-treatment.	Recommend that this information also be collected at the 8-10 year timeframe and contained in monitoring reports and reviewed annually