2.3 BIODIVERSITY AND RESOURCE APPLICATIONS: APPLICATION OF THE FIRE REGIME CONDITION CLASS PROCESS TO COLLABORATIVE MULTI-SCALE LAND MANAGEMENT PLANNING IN THE BOSTON MOUNTAINS, ARKANSAS

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ABSTRACT
Collaborative fire management planning depends on landscape managers finding common ground in their understanding of ecosystem structure and function and in estimates of desired future landscape conditions. The Boston Mountains, Arkansas landscape is dominated by oak-hickory and oak-pine ecosystems that have been altered in composition and structure as a result of past timber management and fire exclusion activities. The Ozark-St. Francis National Forest, The Nature Conservancy, the Arkansas Natural Heritage Commission, private landowners and others are currently engaged in a collaborative project to restore these oak-hickory and oak-pine ecosystems. Due to past land management activities, there is substantially more closed canopy forests and less woodland/savanna than occurred historically under a more frequent fire regime. Historically, low intensity fires burned these systems about every 2-15 years, every 3 years on average. Plant and animal species, such as the royal catchfly, northern bobwhite, Bachman's sparrow, Diana fritillary, Indiana bat, and elk are adapted to the vegetation mosaics that were historically maintained by this more frequent fire regime. In 2003, a project scale Fire Regime Condition Class process was applied at multiple scales to the Boston Mountains to facilitate determination of spatially-explicit landscape scale restoration goals and priorities. In 2002, the USDA Forest Service produced spatial Fire Regime Condition Class (FRCC) data for the conterminous United States (1 km^2 resolution) to support national-level fire planning and risk assessments. Coarse scale FRCC integrates spatial data on biophysical site potential, current vegetative conditions, and historical fire regimes as a coarse measure of the current degree of departure from historical fire regimes. However, this coarse data was not intended for application at finer resolutions, such as for National Forest, Conservation Area or other project-level planning. In April 2003, the USDA Forest Service, Interior Agencies, and The Nature Conservancy completed version 1.1 of a project scale Fire Regime and Condition Class (FRCC) guidebook, intended to help practitioners apply the concepts of FRCC to finer spatial extents (e.g., 10s to 100s of thousands of acres). By following the FRCC process, landscape project teams can collaboratively develop the ecological information necessary to determine the departure between current and reference fire frequency, fire severity, and vegetation mosaics, and in turn, after integration with other data sources determine project priorities and implementation plans. Quantifying fire regime condition departure facilitates the assessment of current ecological sustainability risks, abundance of vegetation-fuel classes relative to reference conditions, and short- and long-term management priorities for diverse resources across and between landscapes. At the scale of the 297,000-acre Bayou Ranger District, this spatially-explicit assessment of fire regime and vegetation-fuel conditions pilots a prototype for revisions to fire- and other resource-related management direction in the Ozark-St. Francis National Forest Land Management Plan. At the scale of ecosystem restoration areas (5,000 – 11,400 acres each), the assessment is facilitating the collaborative development of ecologically-based landscape management goals and objectives by landscape partners. At multiple scales, calculation and mapping of current FRCC will act as a baseline for tracking fire regime restoration success.

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1. INTRODUCTION

Fire is one of the most important ecosystem disturbance processes in the Ozark-Ouachita Highlands of Arkansas, U.S.A. The pine and oak-hickory forests of this area owe their existence to disturbance processes such as wildland fire. Mean fire return intervals prior to 1910 ranged from 2 to 15 years (Guyette and Spetich 2003; Brown and Smith 2000; FEIS 2003). The composition, structure, diversity, and spatial arrangement of the forest and woodland ecosystems have been largely determined by this historical fire regime. However, during the last 80 to 100 years, the historical fire regime has been drastically altered through widespread fire suppression. The virtual elimination of fire as an ecological disturbance process has lead to declines in forest and woodland ecosystem health, sustainability, diversity, and long-term productivity. Fire exclusion has allowed the development of a dense understory and midstory of shade-tolerant, fire-intolerant tree species. As a result, much of the oak-hickory and pine forest ecosystems of the Ozark-Ouachita Highlands are not sustaining themselves due to lack of oak and shortleaf pine regeneration. Open oak and pine woodlands, once common in the Ozark-Ouachita Highlands, have almost been completely replaced by closed canopy forests. In turn, ecological conditions beneficial for fire-adapted plant and animal species have also deteriorated, particularly in glade ecosystems that are being invaded by fire intolerant woody plant species. Plant and animal species, such as the royal catchfly, northern bobwhite, Bachman's sparrow, Diana fritillary, Indiana bat, and elk are adapted to the vegetation mosaics that were historically maintained by this more frequent fire regime.

In 1998 the Bayou Ranger District (Ozark-St Francis National Forest), located within the Ozark-Ouachita Highlands, began using landscape scale prescribed fire for hazardous fuel reduction and habitat improvement. Scientific research and years of field observations have indicated that initiating the use of prescribed fire at this scale would be a cost-effective first step in reestablishing fire as an ecological disturbance process. In 2001, the Bayou Ranger District (in partnership with The Nature Conservancy, Arkansas Game and Fish Commission, Arkansas Forestry Commission, National Wild Turkey Federation, Arkansas Audubon Society, National Park Service, U. S. Fish and Wildlife Service, Quail Unlimited, Caddo Nation of Oklahoma, Rocky Mountain Elk Foundation and Southwest Fire Use Training Academy) designed a more expansive long term landscape scale forest ecosystem restoration project. This project, to be implemented over the next 10 years or more, encompasses a Conservancy priority conservation area and includes 59,700 acres in six areas (5,000 – 11,400 acres each; Table 1). In these "Ecosystem Restoration Areas" (ERAs), restoration actions are needed to promote forest and woodland ecosystem health, sustainability, diversity, long-term productivity, community safety in the wildland/urban interface, and protection of municipal water supplies. Specific project activities for these areas include prescribed fire and commercial, non-commercial, and pre-commercial silvicultural treatments.

In 2002, the USDA Forest Service produced spatial Fire Regime Condition Class (FRCC) data for the conterminous United States (1 km^2 resolution) to support national-level fire planning and risk assessments. Coarse scale FRCC integrates spatial data on biophysical site potential, current vegetative conditions, and historical fire regimes as a coarse measure of the current degree of departure from historical fire regimes (Schmidt et al. 2002). However, this coarse data was not intended for application at finer resolutions, such as for National Forest, Conservation Area or other project-level planning. For example, it is too coarse to provide direction or prioritization for restoration work in the Bayou Ranger District's six ERAs.

In April 2003, the USDA Forest Service, Interior Agencies, and The Nature Conservancy completed version 1.1 of a project scale Fire Regime and Condition Class (FRCC) guidebook, intended to help practitioners apply the concepts of FRCC to finer spatial extents (e.g., 10s to 100s of thousands of acres) (Hann et al 2003). By following the FRCC process, landscape project teams can collaboratively develop the ecological information necessary to determine the departure between current and reference fire frequency, fire severity, and vegetation mosaics, and in turn, after integration with other data sources determine project priorities and implementation plans.

The purpose of this paper is to describe the application of a multi-scale, spatially-explicit fire regime condition class (FRCC) assessment process to the Bayou Ranger District and each of

its ERAs. Quantifying fire regime condition departure facilitates the assessment of current ecological sustainability risks, abundance of vegetation-fuel classes relative to reference conditions, and short- and long-term management priorities for diverse resources across and between landscapes. At the scale of the 297,000-acre Bayou Ranger District, this spatially-explicit assessment of fire regime and vegetation-fuel conditions pilots a prototype for revisions to fire- and other resource-related management direction in the Ozark-St. Francis National Forest Land and Resource Management Plan. At the scale of ERAs, the assessment is facilitating the collaborative development of ecologically-based landscape management goals and objectives by landscape partners. At multiple scales, calculation and mapping of current FRCC will act as a baseline for tracking fire regime restoration success, and to test assumptions about the effectiveness of prescribed burning, thinning, and harvesting treatments over the long term in meeting long-term project objectives.

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Table 1. Current percent composition by potential vegetation type and structural stage for six Ecosystem Restoration Areas on the Bayou Ranger District, Ozark-St. Francis National Forest, Arkansas. ERAs do not encompass the entire 297,000-acre Bayou Ranger District.

Ecosystem Restoration Area and Size	Potential Vegetation Type and Structural Class					
	Oak-Hickory		Oak-Pine Mixed		Shortleaf Pine	
	Closed Canopy Forest	Woodland	Closed Canopy Forest	Woodland	Closed Canopy Forest	Woodland
Eastside (9,500 ac)	100	0	100	0	95	5
Piney (11,400 ac)	100	0	100	0	100	0
Rotary Ann (11,400 ac)	100	0	100	0	100	0
Middle Fork (11,200)	95	5	80	20	91	9
South Fork (5,000 ac)	100	0	100	0	100	0
Oak Mountain (5,600 ac)	100	0	100	0	100	0

2. METHODS

The Bayou Ranger District is located in north-central Arkansas in the Boston Mountains physiographic province of the Ozark-Ouachita Highlands. Dominant potential natural vegetation types include oak-hickory (i.e., *Quercus alba, Q. stellata, Q. velutina, Q. rubra, Carya texana, C. alba, C. cordiformis),* mixed oak-shortleaf pine *(Pinus echinata)*, and shortleaf pine forests. Small patches of prairie/glade ecosystems, dominated by herbaceous grasses and forbs, are embedded within these forest types, but due to the unavailability of data on the locations and conditions of these PNVTs, they were not analyzed separately. Under native fire regimes (i.e., frequent surface fires), oak, oak-pine and pine vegetation types were historically dominated by an open woodland/savanna structure (15-69 ft^2/ac basal area), with patches of closed forest (>69 ft^2/ac basal area), particularly in riparian areas and on select toe and north-facing slopes. Prairies and glades were also historically maintained in an open state by frequent fire. Current conditions include substantially more closed forest and less open woodland/savanna than is expected to have been maintained under historic fire regimes. Table 1 summarizes current structural conditions for each potential forest type in each ERA.

Using available spatial and tabular data wherever possible, spatially-explicit fire regime condition class (FRCC) assessments were completed for the 297,000 acre Bayou Ranger District and for each of six ERAs. ArcView GIS software was used for all analyses. A flowchart of project methodology is illustrated in Figure 1, and each step is briefly described below.

1. Identify biophysical types and model reference conditions – Potential natural vegetation types (PNVT) are one type of biophysical classification based on plant species that are indicators of the natural disturbance regime, site climate, and topo-edaphic relationships. Biophysical characteristics that to a large extent control fire regimes and the distribution of vegetation are reflected in the

distribution of PNVTs. PNVTs are the foundation for stratification of reference and vegetation-fuel conditions, the development of reference models and calculation of departures between reference and current conditions. We classified the project area into three PNVTs — oak-hickory, oak-pine and pine — based on land type association, topography and available National Forest data (i.e., Continuous Inventory Stand Condition or CISC data). These PNVTs became the foundation for modeling reference conditions and mapping FRCC. Quantitative state-transition models for each PNVT were developed in conjunction with the collaborative Field FRCC project (Hann et al. 2003) using the Vegetation Dynamics Development Tool (VDDT) (Beukema and Kurz 2000). For each PNVT, literature reviews (e.g., see Bragg 2002, Sparks 1996, Nelson 1997, Foti and Glenn 1990) and expert input were used to estimate successional transition times, fire frequency and severity, and disturbance probabilities for a relatively simple set of structural stages that were expected to occur historically, and thus represent reference conditions (e.g., Table 2). Structural stages were identified as early seral, mid-seral open, mid-seral closed, late-seral open, and late-seral closed. VDDT models were then parameterized with reference successional and fire disturbance probabilities and run overr 10 Monte Carlo simulations for 500-1000 years each, or until PNVT structural stage composition stabilized over time. For example, Table 2 summarizes the structural classes and fire regime parameters used as input to VDDT, and reference composition obtained as a result for the shortleaf pine PNVT. Modeled outputs were used to represent reference conditions for the Bayou Ranger District as a whole. Expert input was used to adjust Ranger Distrcit-wide reference conditions for each ERA as necessary based on differences in biophysical characteristics and expected differences in the proportions of woodland/savanna and closed forest conditions. For example, the Eastside ERA is dominated by the shortleaf pine PNVT. In this ERA, the oak-hickory PNVT is primarily found on toe slopes, north-facing aspects and floodplains, where closed canopy conditions also tend to occur in these types. Hence, relative to other ERAs, oak-hickory reference conditions in the Eastside ERA are expected to have proportionally more cover of closed oak-hickory forest. Oak-hickory reference conditions for the Eastside ERA include 42% closed forest and 58% woodland/savanna. Comparatively, oak-hickory reference conditions for other ERAs, which tend to have more cover of the oak-hickory PNVT than the Eastside ERA, have greater proportions of woodland/savanna (i.e., 75-100%).

Figure 1. Spatially-explicit fire regime condition class (FRCC) assessment process.

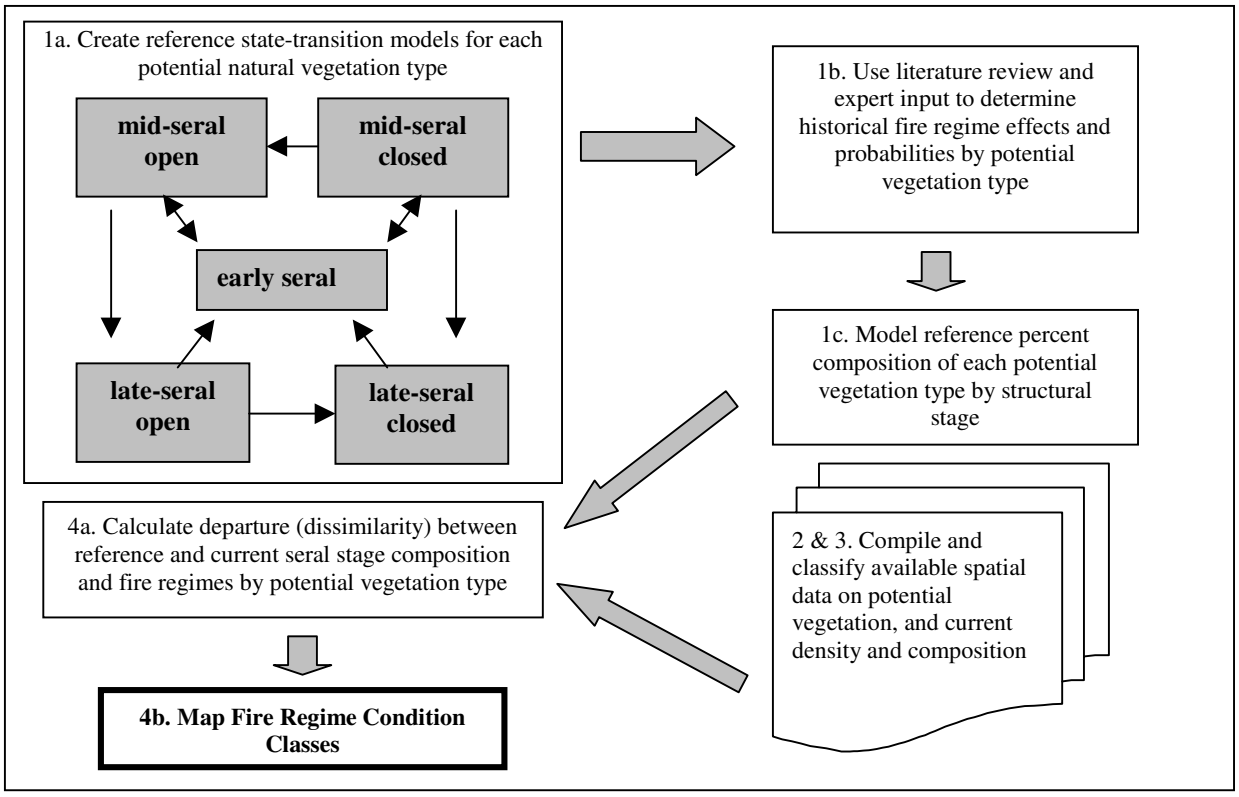

Table 2. Example of reference model attributes and output, shortleaf pine potential natural vegetation type (PNVT), frequent surface fire regime, Bayou Ranger District, Ozark-St. Francis National Forest, Arkansas, using the Vegetation Dynamics Development Tool (VDDT). Model output represents the expected mosaic of user-defined structural/seral stages given the indicated historical fire regime and rates of succession.

Vegetation Type and Structure

Class	% area of PNVT	Description
A	5	Post-fire/disturbance community of forbs and perennial grasses; pine reproduction to 10' tall; openings small (0.25-2 acres) and may have scattered live trees (basal area < 14 ft^2/ac, cover < 20%); more persistent on shallow soils; ≤10 years.
B	5	Mid-seral, closed canopy (basal area >69 ft^2/ac; >80% cover) shortleaf pine, pole size and larger with little understory of forbs and grasses; 10-50 years.
C	20	Mid-seral, woodland/savanna (basal area 14 – 69 ft^2/ac; ≤80% cover) pine dominated overstory with perennial grasses; 10-50 years.
D	60	Late-seral, woodland/savanna (basal area 14 – 69 ft^2/ac; ≤80% cover) pine dominated overstory with perennial grasses and forbs and a limited shrub community; >50 years.
E	10	Late-seral, closed canopy (basal area >69 ft^2/ac; >80% cover) pine dominated overstory with perennial grasses and a limited shrub community; >50 years.
Total	100	

Historical Fire Frequency and Severity (model input)

Fire Severity	Mean Fire Return Interval (years)
Replacement Fire (>80 overstory mortality)	0
Non-Replacement Fire	3
All Fire Frequency	3

2. Map PNVTs using existing spatial data – Mapped PNVTs must coincide with models, fire regime characteristics and reference conditions developed in step 1. For the project area, we obtained currently available CISC data to map oak-hickory, oak-pine and pine PNVTs. Where CISC data was unavailable, we used land type association boundaries, DEMs and adjacency rules to deduce locations of PNVTs that were consistent with fire regime classifications used in VDDT reference models.

3. Classify and map current seral/structural stages, uncharacteristic types, and fire regimes – Seral/structural stages must also coincide with classes used to model reference conditions in step 1. Any existing GIS data pertaining to current seral stage, size class, structure, or any other pertinent vegetation characterization is evaluated and utilized to map structure where appropriate. For assessment areas where existing GIS data is unavailable, an unsupervised classification of Landsat TM or other imagery results in spectral classes that can be calibrated using aerial imagery, field-based plot data, or any other available ancillary data to determine the relationship between the spectral reflectance characteristics from the imagery and current structure/seral stages. Since only 8% of the Bayou Ranger District project area had available spatial data for structural stage mapping, we used 2000-2001 infrared digital orthophoto quads to classify structure and manually digitize current structural stage conditions. Polygons were digitized and labeled as "woodland/savanna" or "closed forest" based on visual comparison with a known subset of polygons throughout the study area. Areas killed by recent red oak borer infestations and mapped by the Ozark-St. Francis National Forest as having experienced a "severe" effect were mapped as uncharacteristic cover types. It was assumed that these areas would not quickly be restored to natural structural and compositional conditions without implementation of restoration actions, such as prescribed fire. Locations of uncharacteristic loblolly plantations (i.e., a state of

the shortleaf pine PNVT) were assumed from industrial forestry company land ownership boundaries. Current fire frequency and severity generally followed PNVT boundaries, except where recent prescribed burning has occurred. Outside recent treatment areas, all PNVTs currently have mean fire return intervals greater than 100 years. Current fire severity percent (percentage of the PNVT that will burn as a stand replacement disturbance during dry windy conditions) is 30% for oak-hickory and oak-pine PNVTs and 50% for the pine PNVT

3. Calculate and map departure in vegetation/fuels and fire frequency/severity – The departure in vegetation/fuels and fire frequency/severity is calculated by comparing reference (e.g., modeled and/or determined from literature review, expert input, etc.) seral/structural stage compositions and fire frequency/severity by PNVT to current conditions. The detailed methodology used will not be described here, but can be found in Hann et al. (2003), and can be applied at any spatial scale. Combined vegetation and fire regime departures (dissimilarity) from reference conditions ranging from 0-33% are classified as "intact" or unaltered (FRCC 1). Departures ranging from 34-66% and 67-100% are classified as "moderate" (FRCC 2) or "high" (FRCC 3) departure, respectively. Areas mapped as "uncharacteristic" (e.g., areas dominated by exotic species) contribute in their entirety to dissimilarity between current and reference vegetation/fuel conditions. A summarized example of the calculation of departure in vegetation/fuels and fire frequency/severity for the shortleaf pine PNVT for the Bayou Ranger District project area and Eastside ERA are provided in Table 3. For calculation of FRCC, structural/seral stages were collapsed into two classes – woodland/savanna and closed forest – due to the lack of available finer-resolution data to distinguish between early-, mid- and late-seral conditions. Local experts confirmed that the key factor driving the need for restoration was the relative proportions of woodland/savanna and closed forest conditions, and seral stage was secondary. With new information, future calculation of FRCC can include a finer breakdown of structural/seral classes, if necessary. Recent restoration actions (e.g., thinning and prescribed burns) in the Eastside ERA has resulted in a lower departure in fire regime characteristics relative to the Ranger District as a whole (Table 3).

FRCC was then mapped by PNVT for the entire Bayou Ranger District, and individually by ERA. A map was also derived depicting management opportunities. For example, closed oak-hickory and oak-pine conditions are expected to occur naturally on north aspects, toe slopes and floodplains. Hence, since our FRCC assessment highlights the need to reduce closed forest conditions and increase woodland/savanna in these PNVTs, actions can first focus on thinning and prescribed burning on south-facing aspects, middle slope positions and rigdetops, thus maintaining closed forest conditions where it would naturally be found given native fire behavior.

3. RESULTS

Fire regime conditions for the Bayou Ranger District as a whole are highly altered for all PNVTs (FRCC 3). This is primarily due to the ubiquitous departure between the amount of closed forest conditions expected under a historical fire regime and the amount currently found across the landscape, and the high departure between reference and current fire frequencies. Fire regime condition class (FRCC) varied slightly between that for the Bayou Ranger District as a whole and that calculated for each ERA. In most cases (e.g., Eastside ERA), this was due to recent restoration actions at the ERA level that have not yet had enough of a spatial influence to be revealed at the Ranger District level. In other cases, differences between FRCC at the Ranger District and ERA levels were due to inherent biophysical characteristics – i.e., the relative amounts and conditions of PNVTs within a particular ERA. Multi-scale FRCC assessments confirm that, while current conditions Ranger District-wide are still highly departed from reference conditions, the District's collaborative project to increase the extent of landscape-scale fire regime restoration within ERAs appears to be on the right track. Through time, periodic FRCC assessments at multiple scales will facilitate monitoring restoration action effectiveness and contributions toward larger goals for achieving desired future conditions Forest-wide.

Table 3. Summarized calculation of departure in vegetation/fuels and fire frequency/severity for the shortleaf pine PNVT for two spatial scales – the Bayou Ranger District and embedded Eastside ERA[1]

Bayou Ranger District (~297,000 acres)

Vegetation/Fuels			% of total shortleaf pine PNVT area	
			woodland/ savanna	closed forest
Reference vegetation conditions (from VDDT model and local expert input)			85	15
Current conditions			18	82
% Similarity			18	15
Total % similarity = 33%; Dissimilarity = (1-33%) = 67%		**FRCC (veg-fuels) = 3 (high departure)**		
Fire regime	Reference (historical)	Current	% Departure	
Fire frequency (MFI, years)	3	100	97	
% of burned area stand replacement	5	30	83	
Mean % departure in fire regime: (97 + 83)/2 = 90%		**FRCC (frequency/severity) = 3 (high)**		

Eastside Ecosystem Restoration Area (9,500 acres)

Vegetation/Fuels			% of total shortleaf pine PNVT area	
			woodland/ savanna	closed forest
Reference vegetation conditions (from VDDT model and local expert input)			89	11
Current conditions			5	95
% Similarity			5	11
Total % similarity = 16%; Dissimilarity = (1-16%) = 84%		**FRCC (veg-fuels) = 3 (high)**		
Fire regime	Reference (historical)	Current	% Departure	
Fire frequency (MFI, years)	3	5	40	
% of burned area stand replacement	5	20	75	
Mean % departure in fire regime: (40 + 75)/2 = 58%		**FRCC (frequency/severity) = 2 (moderate)**		

Oak mortality due to recent red oak borer activity had a substantial effect on fire regime condition class at the ERA level. Extensive and severe insect-caused mortality in the Piney and Rotary Ann ERAs have created uncharacteristic community types that contributed to FRCC ratings of 3 for the oak-hickory and oak-pine PNVTs. Without restoration actions such as ecologically-based prescribed burning, successful oak regeneration will be difficult on these sites. Fire-dependent successional processes will likely be substantially delayed, or trajectories may be completely altered. Similarly, uncharacteristic loblolly plantations in the Eastside ERA contribute negatively to FRCC due to their departure in composition relative to reference conditions. In some cases, these stands occur on private lands and will likely be maintained into the future. On public lands, management direction can serve to drive these stands toward more characteristic community composition, and thus improve FRCC through time.

Management opportunity maps based on FRCC assessments and local information about expected spatial distributions of structural/seral stages revealed the substantial extent of restoration actions needed Ranger District-wide. "Maintenance" opportunities exist in limited areas where vegetation/fuels conditions are similar to reference conditions (i.e., the current limited extent of woodland/savanna conditions), and "restoration" opportunities exist where abundance of particular vegetation/fuels types are greater than or less than reference conditions, or are uncharacteristic. Ranger District-wide, substantial opportunities

[1] See Hann et al. (2003) for methods to calculate departure in vegetation-fuels and fire frequency-severity.

exist to maintain existing woodland/savanna structural stages and thin closed forest conditions where ecologically appropriate (i.e., maintaining closed conditions in floodplains, toes slopes and some north aspects).

4. DISCUSSION AND CONCLUSIONS

Spatially-explicit fire regime condition class assessments at multiple scales can provide critical ecological data for use in prioritization of fire use, fuel restoration and maintenance projects, development of multi-agency fire management plans, development of conservation area strategies, tracking success of restoration strategies, and revision and amendment of land and resource management plans. Specifically, the assessment process presented here can:

- Provide multi-scale assessment of fire regime conditions given available data
- Where applied regionally, provide interim data that can be used for national or regional project selection, prioritization, and planning
- Provide a first iteration for fine scale, high accuracy, longer-term fire regime assessment projects
- Integrate existing ecological spatial data, and expert input across all ownerships
- Improve coarser national scale fire regime condition assessment efforts

The greatest challenges for future applications within the Ozark-St. Francis National Forest, the southern region and other areas will be development and validation of reference conditions, especially for ecosystems where little is known of natural fire regimes or vegetation mosaics. Great care needs to be taken in developing and utilizing reference conditions. Natural (historical) variability is a complex result of natural and human-induced change (Swanson et al. 1993; Kaufmann et al. 1994; White and Walker 1997; Swetnam et al. 1999). Reference conditions are extremely useful as indicators of ecosystem function and sustainability, but do not necessarily represent desired future conditions, or sustainable conditions under current climate, land use or managerial constraints. The Ozark-St. Francis Forest has plans to employ fire history monitoring techniques in its ERAs and extend initial fire research completed by Guyette and Spetich (2003). This and other ongoing local fire research (e.g., effects of periodic fire on the composition and long-term dynamics of upland hardwood forests; effects of periodic fire on the dynamics of oak borer infested upland hardwood forests) will improve local knowledge and models representing reference conditions.

Due to the lack of available spatial data on forest structure, the FRCC assessment for this project used manually digitized polygons from recent infrared orthophotos to represent current vegetative structure. While manual digitization was calibrated with samples of polygons of known structure, as in any mapping effort using remotely sensed data, some errors will result in less than perfect classification results. The nature of FRCC assessments in general represents a trade-off between using the best available consistent data under short-time frames (e.g., 3 months or less for some project applications) and using highly accurate data not currently available at large spatial scales across multiple ownerships. This trade-off necessitates the use of peer review and model and field validation to the extent possible to ensure that data are as robust as possible. However, utilization of three broad FRCC classes reduces the sensitivity of the process to minor errors in structural or PNVT classifications. Through time, based on review and adaptation, each of the assessment steps can be adjusted to enhance the logic and accuracy of FRCC assessments. Overall, this methodology will provide a reliable, consistent characterization of FRCC in a relatively short period of time.

The spatial resolution and availability of existing data precluded the assessment of FRCC for prairie and glade PNVTs. These types were assumed to be embedded within the PNVTs assessed as a part of this project, and in turn will likely benefit from restoration actions taken in other PNVTs. As finer resolution data is acquired, a more precise assessment of restoration needs for these small patch vegetation types and the species that depend on them can be accomplished.

The FRCC assessment completed for the Bayou Ranger District will be used as an integral part of a comprehensive monitoring program to track effectiveness of fire regime restoration actions planned for implementation over the next 10 or more years (U.S.D.A. Forest Service 2003). Comparisons between Ranger District-wide and ERA-level FRCC assessments highlight how small scale efforts may not be adequate to show accomplishments at the Ranger District or Forest levels. This application of a multi-scale FRCC assessment process holds great promise for

creating common ground and desired future conditions for multi-partner collaborative projects, and for future determinations of the scale of restoration and funding needed at the Forest level. Quantified VDDT reference models provide the framework and technical power to design alternative restoration scenarios and model likely outcomes relative to desired future conditions. If applied at regional levels, the process can contribute to the ecological basis for prioritization of fire projects and distribution of funding and resources, or modeling coarse outcomes of alternative fire policies.

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